DESIGN AND FABRICATION OF AN AUTOMATIC WHITEBOARD CLEANER

A thesis
by

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DEPARTMENT OF MECHANICAL ENGINEERING
SONARGAON UNIVERSITY (SU)

MAY 2025

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Submitted to the
DEPARTMENT OF MECHANICAL ENGINEERING
SONARGAON UNIVERSITY (SU)
In Partial Fulfillment Of The Requirements For The Award Of The Degree
of
BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

MAY 2025

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NOTATION

Symbol / Abbreviation	Description	Source / Standard Reference
RPM	Revolutions per Minute	ISO 80000-3
DC	Direct Current	ANSI Y10.5 / ISO 31
A	Ampere	SI Units (ISO 80000-1)
V	Volt	SI Units (ISO 80000-1)
GI	Galvanized Iron	ASTM A653
M	Meter	
M^2	$Meter^2$	
N	Newton	
SL	Serial	
NO	Number	
AWC	Automatic Whiteboard Cleaner	
ASTM	American Society for Testing and Materials	
WH	Watt Hour	
M/S	Meter/Second	
M/S^2	$Meter/Second^2$	

CERTIFICATION

This is certify that the project on ‘Design and fabrication of an automatic whiteboard cleaner’ by Shoykot Hasan (Id-ME2103025352), Md. Nasim Bapare (Id-ME2103025461), Md. Abu Nayeem (Id-ME2103025397), Md. Tunvir Rahman Mollah,(Id-ME2103025098), Md. Shihab Uddin (Id-ME2103025404) has been carried out under our supervision. The project has been carried out in partial fulfillment of the requirements of the degree of Bachelor of Science (B.Sc.) in mechanical engineering in the year of 2025 and has been approved as to its style and contents.

……..
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DECLERATION

We, hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of Nuruzzaman Rakib, Assistant Professor, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thesis has been or is being submitted elsewhere for the award of any degree

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ACKNOWLEDGEMENT

We would like to express our sincere gratitude to **Mr. Nuruzzaman Rakib**, Assistant Professor, Department of Mechanical Engineering, Sonargaon University, for his invaluable guidance, encouragement, and support throughout the development of this project. His expertise and suggestions were instrumental in shaping the direction and success of our work.

We are also thankful to the faculty members and lab technicians of the Department of Mechanical Engineering for their technical assistance and for providing access to laboratory facilities.

Our heartfelt thanks go to our friends and teammates who offered moral support and shared useful insights during the project.

Finally, we are profoundly grateful to our families for their continuous encouragement, patience, and emotional support throughout our academic journey.

ABSTRACT

Now-a-days white boards are widely used in almost every educational institute. About70-80% educational institute around the world uses white board as the writing medium in their class room. They are large in size, for that reason it is very time consuming process to erase the writings from the board with duster. Using duster also reduce the visual quality of the board. If a class continues about one hour then about 8-10% time become waste because of cleaning the board using duster. This project involves the development of an Automatic Whiteboard Cleaner aimed at automating the erasure of whiteboard surfaces to reduce manual intervention and improve consistency. The system is designed for a standard 610mm×455mm whiteboard and utilizes a side-to-side cleaning mechanism. It employs dual DC motor setup- one motor drives a wheeled cleaning module horizontally across the board using a direct drive system while the second motor manages the vertical pressure of the cleaning pad against the board. The movement is achieved through motorized wheels running along guide rails, eliminating the need for belts or gears and simplifying mechanical complexity. The entire system is mounted on a lightweight yet rigid frame, powered by a DC supply, and controlled via a basic switch mechanism for start-stop functionality. This design enhances reliability, reduces maintenance, and provides an effective foundation for further automation in educational and professional environments.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Whiteboards are widely used in educational institutions, offices, and training environments as a primary medium for conveying information. However, manual cleaning of whiteboards is often overlooked, resulting in poor hygiene, reduced visibility, and unnecessary time consumption during transitions between sessions. In response to these challenges, this project proposes the development of an **Automatic Whiteboard Cleaner (AWC)** — an intelligent, electromechanical system designed to automatically clean the whiteboard surface without human intervention.
The AWC is engineered to move across the board using a programmed microcontroller and a motor-driven mechanism, guided by sensors to detect board boundaries. This system enhances user convenience, saves time, and maintains a consistently clean writing surface, aligning with the growing demand for automation in daily tasks.

1.2 BACKGROUND KNOWLEDGE AND PROJECT CONCEPT

Design and development of board cleaning system is a system that is generally used to clean board automatically with the help of a duster. By the use of this automatic system we can save time and energy. It is a new technology that is generally used now a day. A system for cleaning the blackboard and whiteboard wherein a duster is mounted for longitudinal movement on the board and has a motor mounted thereon that is mechanically interconnected to a drive assembly for producing the movement of the duster in an erasing operation. It will use the rack and pinion mechanism to convert the rotary motion of motor into linear motion of pinion. The idea behind the project basically is to simplify the manual use of duster which is quite tedious. This came about as a result of the observation carried out during lectures. Lecturers or students waste time while cleaning the board, hence slowing down lecture hours. Although, different designs have evolved over the years as regards the fabrication of an automated whiteboard cleaner, the main purpose of these designs have not combated the stressful nature of cleaning boards. This project adds to the variety of designs aimed at mitigating the stress associated with cleaning boards.

1.3 PROBLEM STATEMENT

Despite being essential in classrooms and offices, whiteboards often suffer from inconsistent cleaning due to human error or negligence. Manual cleaning is repetitive, time-consuming, and can interrupt the flow of teaching or presentations. These limitations highlight the need for a **smart, automated cleaning solution**. The proposed **Automatic Whiteboard Cleaner (AWC)** aims to resolve this issue by providing a reliable, time-saving system that ensures the board is cleaned thoroughly and uniformly after every use, enhancing efficiency and maintaining professional standards in any working environment.

1.4 OBJECTIVES

- To design and construct a functional prototype of an automatic whiteboard cleaning system.
- To implement an embedded control system for automating the cleaning process.
- To reduce manual effort, time wastage, and dependency on human operation.
- To ensure safe, reliable, and effective operation suitable for classrooms and office environments.

1.5 METHODOLOGY

- System Design: Develop mechanical and electronic subsystems, including frame, wiper mechanism, and movement track.
- Component Selection: Have to choose appropriate DC motors, White Board, Toggle switch, power supply ETC.
- Assembly & Integration: Assemble all components into a single working prototype.
- Testing & Evaluation: Test the device on various board sizes and surface conditions to ensure efficiency.

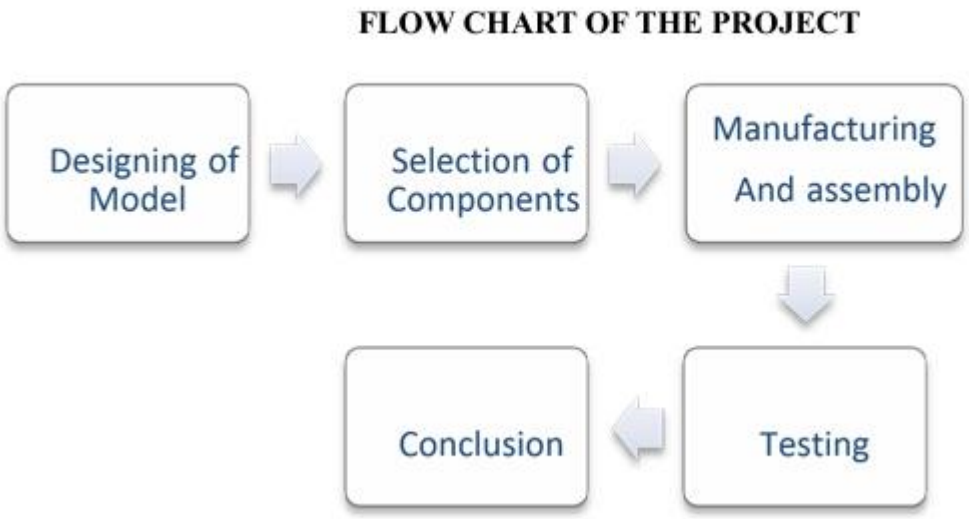


Figure 1.1 Flow Chart of the Project

1.6 PROBLEM OF EXISTING DESIGN AND OBJECTIVE OF NEW DESIGN

In the light of designing an automated whiteboard cleaner, the limitations of two major existing designs will be considered. That is, the electric board cleaner and the automatic whiteboard cleaner which makes use of belts. Most belts have low wear and tear resistance and with the frequent operation of the duster (i.e. the cleaning process), the belt is likely to cut and hence makes the device or the cleaner less useful. In the process of trying to change the belt, the whole components may have to be loosened which is time – consuming. However, as for the case of the electric board cleaner, the

idea of applying manual effort still comes in. The difference being that effort applied is less since it is powered electrically. This project is aimed at modifying the automatic whiteboard cleaner by replacing the belts with chains which will improve the efficiency and effectiveness of the cleaner. The objective of this project is to reduce the stress of cleaning the board by using an automated duster. This objective Would be achieved through the following specific objectives-

- Conceptualization of an automated whiteboard cleaner
- Preliminary and detailed design of new mechanism
- Fabrication of the automated whiteboard cleaner
- Performance testing of the automated whiteboard cleaner

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CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In recent years, the integration of automation into daily human activities has grown significantly, aiming to enhance convenience, efficiency, and consistency in routine tasks. Educational and professional environments often rely heavily on whiteboards for presentations, instruction, and collaboration. However, the cleaning of these boards remains predominantly manual, time-consuming, and inconsistent. As such, the development of an automated whiteboard cleaning system addresses a practical Need for improved productivity and cleanliness.

This literature review explores the existing body of research and technological developments relevant to the design and implementation of an automatic whiteboard cleaner. It begins by examining conventional and automated cleaning methods, followed by an analysis of mechanisms used for linear motion, motor control systems, and microcontroller-based automation. Furthermore, it investigates existing cleaning technologies, safety considerations, and energy management practices applicable to small-scale electromechanical devices. By identifying the strengths and limitations of previous approaches, this review establishes a foundation for the proposed system and highlights the innovation it offers in terms of simplicity, affordability, and Functionality.

2.2 OVERVIEW OF THE STUDY

The purpose of this study is to design and develop a low-cost, efficient, and user-friendly automatic whiteboard cleaning system that minimizes manual effort and ensures consistent erasure. The study focuses on solving a common yet often overlooked problem in classrooms, offices, and conference rooms erasure and reduced productivity. Manual whiteboard cleaning which is not only repetitive but can also Erasure and reduced productivity,

This project utilizes a side-to-side linear motion cleaning mechanism driven by a dual DC motor setup. Unlike more complex systems that rely on belts, gears, or programmable controllers, this design adopts a simpler approach using direct-drive wheels and a basic control mechanism. The aim is to keep the system mechanically straightforward, cost-effective, and suitable for compact board sizes such as 610mm×455mm.

The study involves several key phases, including conceptual design, component selection, mechanical fabrication, electrical integration, and testing. Each phase is supported by relevant theoretical frameworks and literature, ensuring that the system is both functionally sound and practically viable.

In doing so, the research contributes to the field of small-scale automation by offering a prototype that can be further improved with advanced control, sensor integration, and adaptability to larger surfaces. The study also evaluates the limitations and potential future developments of the proposed system.

2.3 DESCRIPTION OF OTHER RELATED WORK

Design and Development of Automatic Whiteboard Cleaner for Effective Cleaning Mechanism using Arduino:

This project presents an automatic whiteboard cleaner powered by an Arduino Uno microcontroller, designed to automate the cleaning process and provide a reliable and efficient solution for whiteboard maintenance. The system uses DC motors, guide rails, and a cleaning pad mounted on a carriage to move horizontally across the board, mimicking manual cleaning actions. The motor's movement is controlled through limit switches and an L298N motor driver, enabling back-and-forth motion for uniform cleaning.
The system can be triggered using a push button or wireless control (e.g., Bluetooth or IR). The Arduino controls the entire process, providing the flexibility to modify cleaning patterns or adjust for different board sizes. It also offers hands-free operation and ensures consistent cleaning results.

Design and Development of Automatic Whiteboard Cleaner for Effective Cleaning By using rack and pinion Mechanism:

This project introduces an automatic whiteboard cleaner that utilizes a rack and pinion mechanism to convert rotational motion into precise linear motion. This allows the cleaning pad to move smoothly across the whiteboard, ensuring consistent and efficient cleaning. The system is controlled by a microcontroller (e.g., Arduino), with a DC motor or stepper motor rotating the pinion gear, which moves the cleaning carriage along the board.

The system offers precise linear motion, making it ideal for applications requiring controlled movement, and is cost-effective and durable. It features limit switches or sensors to stop or reverse the motor when the cleaning carriage reaches the end of the board.

However, it has some limitations, such as being limited to straight paths, generating mechanical noise, and requiring manual repositioning if sensors fail. The system is also non-adaptive, lacking the ability to adjust the pressure of the cleaning pad automatically.

Design and Development of Automatic Whiteboard Cleaner for Effective Cleaning by Remote-Controlled Operation:

This project involves the design and development of an automatic whiteboard cleaner equipped with remote control operation and an adjustable cleaning speed mechanism. The system uses DC motors to move a cleaning unit (such as a wiper or sponge) horizontally—and optionally vertically—across the board. Users can control the device remotely, adjusting direction and speed based on cleaning needs.

The adjustable speed feature is implemented using a motor driver circuit and Arduino microcontroller, which regulates motor speed through PWM (Pulse Width Modulation) signals. Speed can be set using a potentiometer, buttons, or remote interface, allowing for more effective cleaning depending on the ink condition.
The cleaner offers a hands-free, user-friendly, and energy-efficient solution to maintain whiteboard cleanliness. However, it includes additional complexity, requires more components, and may be costlier compared to simpler models.

Easy-Erase for Whiteboard Prototype:

This project presents the design and development of an automatic whiteboard cleaner named Easy-Erase, aimed at automating the regular maintenance of whiteboards in educational and professional settings. The system combines mechanical, electronic, and sensor-based technologies to deliver an efficient and user-friendly cleaning solution.

Powered by rechargeable batteries, the device features a DC motor controlled by a motor driver, which enables precise movement of the cleaner across the whiteboard surface. An ultrasonic sensor plays a key role in detecting boundaries and mapping the whiteboard using distance measurements. These inputs are processed by an Arduino Uno microcontroller, which acts as the central control unit.

The cleaner employs brushes or microfiber cloths to remove ink and residue from the board. Smart algorithms use sensor data to determine an optimal cleaning path, ensuring full surface coverage and adaptive navigation around any obstacles.
A manual push button allows users to initiate the cleaning cycle, offering both automated and user-controlled functionality. The system is compact, mobile, and efficient, addressing the need for clean whiteboards while reducing human effort.

Preliminary Design of an Automated White Board Cleaner:

The project demonstrates the application of embedded systems and automation in everyday tasks, promoting efficiency, hygiene, and sustainability in collaborative environments.
Whiteboards introduced in the mid-1960s and widely adopted by the late 1980s, replaced chalkboards due to concerns over chalk dust. While useful, they require frequent cleaning, which can be inconvenient during lectures or meetings. Manual erasing is time-consuming and disrupts the flow of teaching or discussion, especially when the board is large or the eraser is not readily available.
To address this, an automated whiteboard cleaner has been developed. The system is based on a horizontal-motion mechanism, where a motor-driven shaft powers pulleys or chains to move a cleaning duster across the board. The design significantly reduces the stress and time associated with manual cleaning.

The automated system replaces manual wiping with a motorized, chain-driven duster that moves horizontally across the board surface. It eliminates the drawbacks of earlier designs using belts, which are prone to wear and require disassembly for maintenance. By using chains instead of belts, the new design enhances durability, efficiency, and ease of maintenance.

Design and development of smart whiteboard cleaner in Classroom application:

The Smart Whiteboard Cleaner is an automated system designed to replace manual whiteboard cleaning in classrooms and offices. It aims to save time, reduce effort, and improve convenience for teachers and users. The system uses DC or stepper motors to move a duster horizontally and vertically across the board. It includes features such as multiple cleaning modes (left, right, or full board), limit switches, infrared sensors, and is controlled by a microcontroller (e.g., dsPIC30F401).

Some designs also integrate advanced features like water sprinklers, toggle mechanisms for pressure adjustment, and motion analysis for detecting board stains. The system is simple, cost-effective, and can be operated with a single button press (e.g., DPDT switch), making it suitable for educational and professional settings.

Design and Fabrication manual board cleaner:

A manual board cleaner is a basic, hand-operated tool designed to wipe off markings from whiteboards or chalkboards. It usually features a lightweight handle with a cleaning surface made of soft, absorbent materials like felt or foam. This allows users to easily grip and move it across the board to remove dry-erase ink or chalk residue effectively.
Manual board cleaners are affordable, easy to use, and require no electrical power, making them ideal for everyday use in classrooms, offices, and meeting spaces. However, they depend entirely on human effort, which can be tiring and inefficient when cleaning larger boards or during frequent use. To maintain optimal performance, the cleaning surface must be cleaned or replaced regularly.

Automatic Whiteboard Cleaner:

The Automatic Whiteboard Cleaner is a low-cost, user-friendly mechanical system designed to reduce the time and effort required for manual board cleaning. It operates using a hand wheel that transmits rotary motion through a bevel gear to a shaft, which then drives a chain and sprocket mechanism to move a duster horizontally across the whiteboard. The project applies principles of adaptive, developmental, and rational design, focusing on factors such as material choice, durability, safety, and ease of manufacturing. The cleaner ensures efficient, consistent erasing while eliminating interruptions during teaching or presentations. The outcome is a functional prototype that performs smooth and effective cleaning, with potential for future upgrades like motorized or remote-controlled operation. Overall, the system enhances productivity in educational and professional environments by automating a routine task.

2.4 OUR PROJECT DETAILS

This project introduces a simple, low-cost automatic whiteboard cleaner designed for a 610mm×455mm board. It uses a basic toggle switch control system and two DC gear motors to automate the horizontal cleaning process. The system aims to reduce manual effort and save time, especially in classrooms and office settings.

The cleaner operates by moving a cleaning pad or eraser linearly across the whiteboard via a motor-driven shaft mechanism. Once powered on through the toggle switch, the motors move the cleaning frame from one end of the board to the other, wiping away ink as it travels. The operation is manually controlled, with users starting and stopping the system as needed.

The device offers advantages such as ease of use, affordability, compact size, and low maintenance. However, it also has limitations, including manual-only operation, a fixed horizontal cleaning path, no speed control, and lack of smart features such as ink detection or feedback. It is best suited for smaller boards and may require modification for larger surfaces.

CHAPTER 3

MATERIALS AND METHODS

3.1 DESCRIPTION OF THE DESIGN

The design of the Automatic Whiteboard Cleaner is centered on a simple yet effective mechanical system that performs horizontal wiping across a standard whiteboard surface measuring 610mm×455mm. The system is constructed to be lightweight, cost-effective, and easily reproducible, avoiding complex elements such as gears, belts, or advanced programming.

1. Mechanical Structure: The cleaning module is mounted on a frame that spans the width of the whiteboard. The module includes a cleaning pad affixed to a base that is moved horizontally across the board using motorized wheels. These wheels are guided along parallel support rails fixed at the top and bottom edges of the board. The frame is designed to be compact and stable, ensuring that the motion of the cleaning unit remains aligned and smooth during operation.

2. **Drive Mechanism:** The system employs two DC motors. The first motor is responsible for driving the cleaning unit horizontally from one side of the board to the other. This is achieved using directly connected Plastic wheels, thus eliminating the need for Shaft transmission systems. Two motor Control wiper to move forward and backward and it to press gently against the board surface during cleaning end of the cycle.

3. **Cleaning Pad:** The cleaning pad is made of soft, absorbent material suitable for dry-erase marker ink. It is mounted on a flexible base to maintain consistent contact with the board during motion. The pad can be removed and replaced easily for maintenance or cleaning purposes.

4. **Control System**: The system is designed to be manually operated via a simple Toggle switch for operation. Included to detect when the cleaning unit reaches either edge of the board, have to push the switch to reversing the direction of travel or stopping the system to prevent motor strain.

5. **Power Supply:** A DC power adapter supplies electrical power to both motors. The circuitry includes a motor driver module and basic control logic to manage motor direction and actuation. For future versions, a battery-powered or solar-assisted power option may be considered for improved portability.

6. **Ease of Maintenance:** The design allows for quick disassembly and reattachment of the cleaning pad, motor unit, and frame components. This makes the system suitable for long-term use in educational and office settings where regular maintenance is necessary.

3.2 MACHINE OPERATION

The operation of the Automatic Whiteboard Cleaner begins with the system positioned at one end of the whiteboard. Initially, the cleaning pad remains slightly lifted to avoid accidental contact with the surface. Upon activation, either through a manual switch, the system initiates the cleaning sequence. The vertical motor engages first, lowering the cleaning pad to make consistent and gentle contact with the whiteboard surface. Once proper contact is established, the primary motor powers the

motorized wheels, causing the cleaning assembly to move horizontally along the guide rails mounted on the board's frame.

As the cleaning unit travels across the board, it wipes off the ink from the surface using the attached cleaning pad. When the unit reaches the opposite end of the board, a limit switch or sensor detects the boundary and triggers the control system to either stop the motor or reverse its direction, depending on the design configuration. In single-pass mode, the system halts after reaching the end, while in return mode, the cleaning module reverses direction and travels back to its initial position for a more thorough cleaning.

After completing the cleaning path, the vertical motor retracts the cleaning pad from the surface to avoid dragging during repositioning or standby. Once the operation is complete, the system either powers down or remains in a standby state awaiting the next command. In automated configurations, this may be controlled via programmed intervals, while in manual systems; the user resets the switch to begin the next cycle. Basic safety mechanisms are included to handle unexpected obstructions or power issues, ensuring reliable and safe operation during use. The DC motors are primarily devices used to convert electrical energy into physical or mechanical energy.

3.3 COMPONENTS USE IN THIS PROJECT

1. White Board
2. Dc Gear Motor
3. Duster
4. Channel
5. Wheel
6. Adapter
7. Electric Wire
8. Toggle Switch Etc

Dc gear motor: A DC gear motor is an electromechanical device that combines a direct current (DC) motor with a gearbox to provide increased torque and reduced speed in a compact unit. The motor converts electrical energy into rotational mechanical energy, while the attached gearbox modifies the output by lowering the speed and multiplying the torque. This makes DC gear motors particularly useful in applications where controlled movement and high torque are required, such as in robotics, automated machinery, and small-scale mechanical systems. Available in various configurations—such as brushed, brushless, spur, and planetary designs—DC gear motors can be selected based on required specifications like voltage, gear ratio, torque output, and rotational speed. Due to their simplicity, efficiency, and versatility, they are widely used in embedded systems and automation projects, including devices like the automatic whiteboard cleaner, where precise and reliable motion control is essential.



Figure 3.1 Dc gear motor

Plastic Wheel: A plastic wheel is a lightweight, durable, and cost-effective component commonly used in small-scale mechanical and robotic applications. Typically made from high-strength polymers such as polypropylene, nylon, or ABS, plastic wheels offer excellent resistance to corrosion, chemicals, and environmental conditions. These wheels are often used in systems where weight reduction is critical and where heavy load-bearing is not a primary requirement. In projects like the automatic whiteboard cleaner**,** plastic wheels are ideal due to their low rolling resistance, affordability, and compatibility with DC gear motors, enabling smooth and efficient movement across the board surface.



Figure 3.2 Plastic Wheel

White Board: A whiteboard is a smooth, glossy writing surface designed for non-permanent markings using dry-erase markers. Typically made from materials such as melamine, painted steel, or glass, whiteboards are widely used in educational institutions, offices, and collaborative environments for teaching, presentations, and brainstorming. Unlike traditional chalkboards, whiteboards are cleaner, easier to maintain, and provide better visibility. They come in various sizes and may be wall-mounted or portable, depending on the intended use. The board's material and finish are crucial factors influencing the effectiveness of the cleaning process, marker residue removal, and mechanical movement of the cleaning apparatus.



Figure 3.3 White Board with Channel

Toggle Switch: A toggle switch is a manually operated electrical switch that uses a lever or handles to open or close a circuit. It typically has two positions: ON and OFF, although some types may have more. Toggle switches are widely used in electronic devices, machinery, and DIY projects due to their simple operation and reliability. When the lever is flipped, it changes the internal contacts to either allow or interrupt the flow of current. In projects like the **automatic whiteboard cleaner**, a toggle switch can be used to control the power supply to motors or circuits easily and effectively.



Figure 3.4 Toggle Switch

12V Adapter: A 12V adapter is an external power supply device that converts AC mains electricity (typically 110V or 220V) into a stable 12V 5A DC output. It is commonly used to power low-voltage electronic devices such as routers, LED lights, motors, and Adriano-based systems. The adapter typically includes a plug-and-play connector and built-in circuitry for voltage regulation and protection against over current or short circuits. In the **automatic whiteboard cleaner** project, a 12V adapter provides a reliable power source for DC gear motors and other electronic components.



Figure 3.5 12V Adapter

3.4 FABRICATION DETAILS

The design diagram of the system is shown as below:

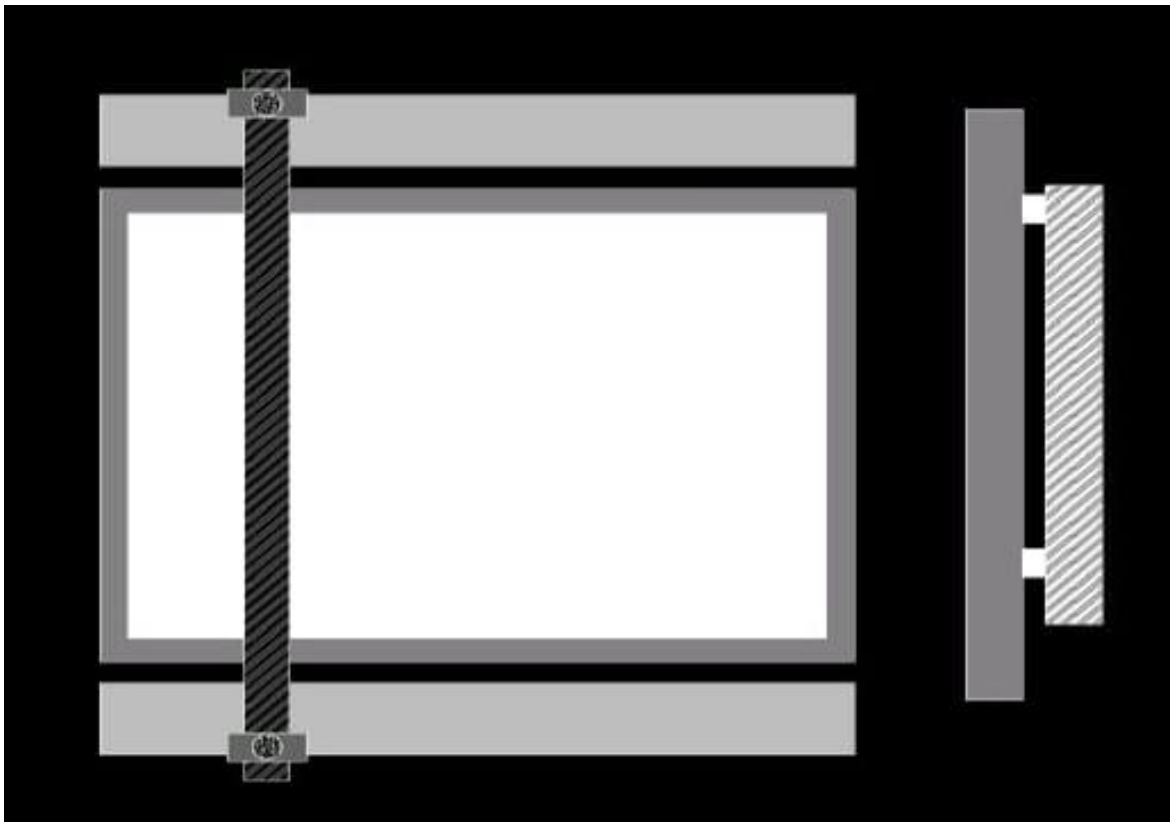


Figure 3.6 3D Marker Board

Specification of Components

SL NO.	COMPONENTS	MATERIALS
01	White Board	Wooden
02	Dc Gear Motor	8 RPM
03	Duster	Foam
04	Channel	G.I
05	Wheel	Plastic
06	Adapter 12V	High density plastic
07	Electric Wire	Copper
08	Toggle Switch	Plastic & Metal

Table 3.1 Specification of Components

CHAPTER 4

OBSTACLES ENCOUNTERED AND PROJECT COST ESTIMATION

4.1 INTRODUCTION

Obstacles refer to unforeseen challenges, limitations, or impediments that arise during the execution of a project, which may hinder progress or delay the achievement of intended outcomes. These may be technical, financial, logistical, or operational in nature, and often require strategic planning, problem-solving, and adaptation to overcome effectively.

4.2 OBSTACLES ENCOUNTERED

Throughout the development of the automatic whiteboard cleaner, several technical and logistical obstacles were encountered that impacted the project's progression. A recurrent issue was the damage to the DC motors, primarily caused by overloading and inadequate torque capacity, which rendered them incapable of sustaining the desired mechanical operation. Additionally, the system experienced wheel slippage, which compromised the stability and directional control of the cleaner during motion. Another mechanical complication involved the dismounting of motor shafts, likely due to improper alignment and the absence of robust coupling mechanisms, leading to inconsistent performance.

Component sourcing presented further challenges, as it proved difficult to obtain essential accessories, such as suitable channels, wheels, and structural elements, within local availability and budgetary constraints. This scarcity necessitated design adjustments and substitutions, which, in some cases, affected the system’s overall efficiency and build quality. An alternative method for power transmission, employing a gear and chain mechanism, was also explored; however, this approach was ultimately unsuccessful due to the motor’s limited power output, which was insufficient to drive the system under load. Despite these adversities, iterative testing, component realignment, and design modifications facilitated progressive improvements toward achieving the intended functionality of the device.

After overcoming various technical and logistical challenges, the automatic whiteboard cleaner project has been successfully completed. The design and development process involved iterative testing, troubleshooting, and optimization to address issues such as motor damage, wheel slippage, and power transmission inefficiencies. Through careful selection of components, modifications to the mechanical structure, and refinement of the power system, the final prototype achieved the intended functionality. The project serves as a valuable demonstration of problem-solving, engineering design, and practical implementation, contributing to potential future advancements in automated cleaning systems.

4.3 COST ESTIMATION

The cost analysis of the automatic whiteboard cleaner project involved evaluating expenses related to materials, components, and fabrication. Major costs were attributed to DC gear motors, wheels, GI channels, power supply units, and miscellaneous hardware. Additional expenses arose from trial-and-error testing and replacing damaged parts. Despite budget constraints, the project was completed within a reasonable cost range through careful resource management and the use of locally available materials. Cost Breakdown Table Shown below,

COST ANALYSIS REPORT-

Sl no.	Description	Quantity	Unit price(Taka)	Total price(Taka)
01	White Board	01 PCS	1050	1050
02	Dc Gear Motor	02 PCS	550	1100
03	Duster	01 PCS	200	200
04	Channel	07 Ft	150	1050
04	Wheel	02 PCS	120	240
06	Adapter 12V	01 PCS	220	220
07	Electric Wire	03 YRD	20	60
08	Toggle Switch	01 PCS	120	120
09	Transport	-	1000	1000
10	Workshop	-	2200	2200
Total Price				**7240 Taka**

Table 4.1 Cost analysis

CHAPTER 5

RESULT AND DISCUSSION

5.1 FINAL RESULT

After completing the construction and testing phases of the Automatic Whiteboard Cleaner, the system performed as expected. The device successfully demonstrated the ability to move smoothly from side to side across the 610mm×455mm whiteboard surface, effectively cleaning it using the mounted cleaning pads. The dual DC motors operated in synchronization, controlled by a toggle switch system, confirming the reliability of both the mechanical and electrical design. The final result validates that the proposed concept was practical, functional, and capable of achieving the primary goal—automating the whiteboard cleaning process efficiently.

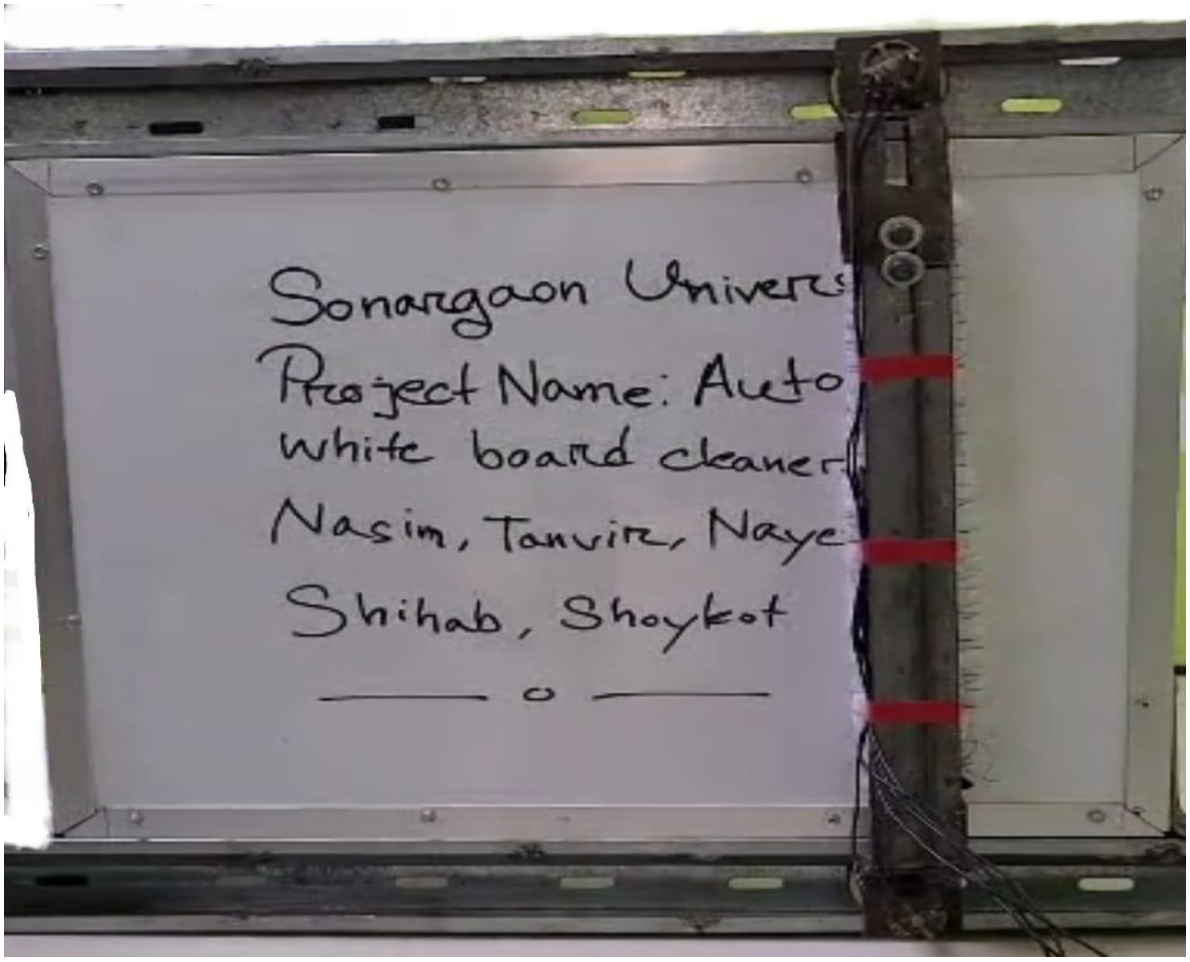


Figure 5.1 Project Operation

5.2 MATHMETICAL CALCULATON

Data:

Friction force between wheel and bar surface
Wheel material = Plastic
Track material = Metal (bar)
Coefficient of friction (μ) = 0.2
Total weight of the wiper (m) = 1.8 kg

Here, Normal Force between Wheel and wiper (N),

N= m.g
N= 1.8 kg *9.81 m/s^2
N= 17.658 N

Frictional Force between Wheel and wiper **(**F_f)

$F_f = \mu \cdot N$
F_f = 0.2*17.658 N
F_f = 3.53 N

Total (Both Side) Frictional Force between Wheel and wiper is **3.53 N**

Acceleration of Cleaner:

Distant (d) = 580mm = 0.58m
Time (t) = 24.30 s

Cleaning Speed (v) = d/t
= 0.58m /24.30s
= 0.024m/s

Acceleration of Cleaner (a) = v/t
= (0.024/24.30)m/s^2
= 0.000988 m/s^2

Wiper Movement Observation:

No. of Obs.	Direction	Time (S)	Remark
01	Left to Right	24.2	First Movement
02	Right to Left	24.7	First Return Movement
03	Left to Right	24.1	Second Movement
04	Right to Left	24.9	Second Return Movement
05	Left to Right	24.6	Third Movement
Average Time		24.5	Result over Five Movement

Table 5.1 Wiper Movement Observation

5.3 CLEANING PERFORMANCE

To evaluate the efficacy of the Automatic Whiteboard Cleaner, several parameters were assessed under controlled conditions:

Type of marking:

White Board Marker was tested to understand their impact on cleaning difficulty. These included:

Duration of marking:

Markings were left on the board for varying durations prior to cleaning:

Sl No	Fresh	After 10 Minutes	After 1 Hour
01	24.21	24.36	24.25
02	24.30	24.42	24.20
03	24.25	24.30	24.30

Table 5.2 Duration of marking

We wrote on the white board using a marker and conducted erasing tests immediately after writing and 10 minutes later, an even one hour later, through our observation, we found that there was no significant difference in the ease or effectiveness of erasing at these different time intervals. This consistency is likely due to the high-quality wiper material we used, which maintained effective cleaning performance regardless of the time elapsed since writing.

Coverage of Marking:

Marking coverage was categorized as:

Sl No	Description	Coverage area %
01	Low	Upto 25%
02	Medium	26-75%
03	High	76-100**%**

Table 5.3 Coverage of Marking

Total board area= 610mm×455mm
= 0.61m×0.455m
= 0.28m^2
Area of cleaning = 580mm×410mm
= 0.58m×0.41m
= 0.24m^2
Area of cleaning percentage = (Area of cleaning/Total Area) × 100
= (0.24m^2/0.28m^2)×100
= 85.71%

From practical inspection we found that our coverage of marking area is **85.71%** which goes in **High** categories.

Number of Cleaning Passes**:**

Durations	Cleaning Percentage Number of pass (For 1)	Cleaning Percentage Number of pass (For 2)
Fresh	95%	100%
After 10 minutes	95%	100%
After 1 Hour	90%	100%

Table 5.4 Cleaning Percentage

We wrote on the whiteboard using a marker and conducted erasing tests immediately after writing, 10 minutes later, and even 1 hour later. We observed that in the first test (immediately after writing), approximately 90% of the ink was cleaned in the first pass, and 100% was cleaned after the second pass. The same result was observed in the test conducted 10 minutes later. However, in the test conducted 1 hour later, slightly less ink was cleaned in the first pass—still around 90%—but complete cleaning (100%) was achieved after the second pass. In conclusion, in all three observations, our cleaning performance reached 100% within a complete cycle (two passes).

Cleanliness Assessment (Qualitative):

Post-cleaning cleanliness was subjectively assessed and categorized as:

Sl No	Cleaning Type	Description
01	Excellent	no visible residue or streaks
02	**Good**	**minimal residue, no noticeable streaks**
03	Fair	significant markings or streaks remain
04	Poor	significant markings or streaks remain
05	Unacceptable	little to no cleaning observed

Table 5.5 Cleanliness Assessment (Qualitative)



Figure 5.2After One Pass



Figure 5.3After Two Passes

From practical inspection we found that our coverage of marking area is **85.71%** which goes in **Good** categories.

5.4 CLEANING TIME AND POWER CONSUMPTION

The efficiency of the Design and fabrication of an Automatic Whiteboard Cleaner was evaluated by measuring several operational parameters, focusing on time, speed, resource usage, and coverage.

Cleaning Time:

T=24.21s+24.30s [By taking a complete Cycle]
T= 48.51s

Power Consumption:

Motor Power 20w
For 2 motor, Power (P) = 40w
Time (t) = 48.51 s [For a complete cycle]
Time = 48.51/3600 h
= 0.0134h

Electricity consumption (KWH) = P*T/1000
= (40*0.0134/1000) KWh
= 0.000539KWh
= **0.539 Wh**

5.5 RELIABILITY AND DURABILITY

Number of Cleaning Cycles Performed:

A total of 50 successful cleaning cycles were conducted during the testing phase. Each cycle involved the system completing a full pass across the 580mm×410mm board surface.

Frequency of Malfunctions:

Malfunctions occurred in 4 out of 50 cycles, yielding a malfunction rate of **8%**. These malfunctions were mostly minor and did not cause permanent damage or system failure.

Type of Malfunction:

The following types of malfunctions were observed:

- Instances of the cleaning head getting slightly misaligned, resulting in partial area coverage.
- Due to friction between wheel and channel sometimes wheel slipped into channel
- Due to long time operation sometimes motor turns off.
- Due to uneven friction between the two wheels, the wiper occasionally gets stuck

Maintenance Requirements:

- Cleaning the cleaning head every 30 cycles to remove accumulated ink residue
- Have to check Wheel grip after 80-90 complete cycle
- Overall, the maintenance frequency was low and manageable.

Wear and Tear of Components:

After 60 cleaning cycles, an inspection revealed:

- Cleaning head showed light abrasion but remained functional.
- Motors operated normally, though one showed signs of heating during prolonged use.
- Structural components remained intact without cracks or significant stress.
- This indicates that the system components are reasonably durable for light-to-moderate usage.

Obstruction Handling:

The system was tested by placing small obstacles (e.g., a dry marker cap) on the board surface. Observations showed:

- The cleaning mechanism paused when encountering a rigid object, preventing motor strain
- In some cases, the mechanism pushed aside soft or rounded obstructions without damage
- A restart was sometimes necessary after manual removal of the obstacle

The system showed basic but effective obstruction handling and did not suffer damage during such tests.

5.6 USER EXPERIENCE

Ease of Use:

The system was designed with simplicity in mind. It features a Toggle switch control for starting and stopping the cleaning process. Users reported that the system was intuitive and easy to operate, requiring no prior training. The automatic return-to-start feature further enhanced usability.

Safety Features:

Several safety mechanisms were incorporated and tested:

- Soft Start Mechanism
- Enclose moving Parts
- Low-voltage (12V DC) design to reduce electrical hazard
- Smooth, rounded edges on the cleaning module to avoid user injury

The system responded reliably during obstruction testing, and no safety incidents were observed during operation.

Messiness of Operation:

The cleaning mechanism used no fluid in normal operation, relying on a dry erasing method. As a result, the process was clean and mess-free. In extended testing, minimal marker residue buildup was observed on the eraser, which could be addressed with periodic maintenance. There was no dripping, splashing, or dust scattering**.**

Integration with Existing Board:

The cleaner was tested on a standard 610mm×455mm whiteboard, and it integrated smoothly with the setup. The mounting frame was non-invasive and did not damage the board. It could be easily removed or reattached, ensuring compatibility with most commercially available boards of similar size.

User Feedback:

Informal user testing was conducted with 6 participants including teachers and students. Feedback was largely positive:

- 4 out of 6 found it convenient and time-saving
- 1 member noted that the system could be improved by adding a remote control
- Another member suggest that the system improved by timer and limit switch.
- All users appreciated the clean and quiet operation**,** and most suggested it would be useful in classrooms with frequent board usage

5.7 FINAL PROJECT

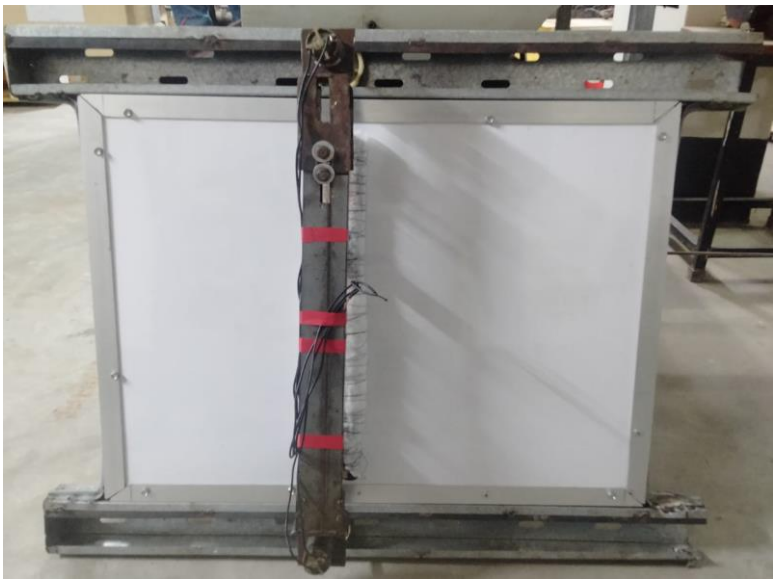


Figure 5.4 Final Project

5.8 APPLICATION

The Automatic Whiteboard Cleaner has a wide range of practical applications, especially in environments where whiteboards are used frequently and need to be cleaned often. Some of its key applications include:

- Educational Institutions: In schools, colleges, and universities, it can save time during lectures by automatically cleaning the board, allowing teachers to focus more on teaching.

- Offices and Conference Rooms: During meetings and presentations, the device can keep whiteboards clean without interrupting the workflow, improving overall productivity.

- Smart Classrooms: Can be integrated into smart classroom systems for automated board maintenance and better user experience.

- Public Speaking Venues: Useful in training centers, workshops, or seminars where quick and frequent whiteboard use is common.

- Accessibility Support: Helps individuals with physical disabilities that may have difficulty reaching and cleaning whiteboards.

Hygiene-Sensitive Areas: Reduces the need for manual contact with the board, which can be important in healthcare training centers or clean environments.

5.9 ADVANTAGES OF THE PROJECT

- Easy Cleaning
- No Manual Effort Needed
- Fast Board Cleaning

5.10 LIMITATIONS

- Fixed Board Size Compatibility: The current design is tailored for a 610mm×455mm whiteboard. It lacks adaptability to accommodate boards of varying dimensions without structural modification.
- No Obstacle Detection: The system does not include sensors to detect obstacles or the presence of markers or other objects on the board, which may interrupt or damage the cleaning process
- Manual Start/Stop Operation: The prototype relies on basic switching or manual control, lacking automation features such as scheduled cleaning or remote operation.
- Limited Pressure Adjustment: the cleaning pressure applied by the wiping mechanism is fixed and may not be equally effective across different board materials or levels of dirtiness.
- No Residue Collection: The system wipes the board surface but does not include any mechanism to collect or manage the erased ink particles, potentially leaving dust behind.

- Surface-Only cleaning: The cleaner only removes surface-level marker ink and is not effective against permanent stains or dry-erase ghosting that may require chemical cleaning.
- No Vertical Movement: The cleaning mechanism moves only in a horizontal direction. If the board is used in sections or unevenly, it may require multiple cleaning cycles for complete coverage.
- Power Dependency: The system depends entirely on an external power source and lacks battery backup or energy-saving features, limiting its portability and energy efficiency

5.11 DISCUSSION

The Automatic Whiteboard Cleaner project represents a practical solution to a common but often overlooked problem in educational and professional settings—manual whiteboard cleaning. Through this project, we explored the integration of mechanical, electrical, and control systems to automate a repetitive task, demonstrating the efficiency and potential of simple automation in daily life.
One of the key highlights of the system is its dual motor design, which ensures balanced and smooth side-to-side motion across the board surface. By using a Toggle Switch as the controller and two dc gear motor driver, we were able to precisely control the direction and speed of the motors through a basic toggle switch interface. This made the system both reliable and user-friendly.
The design was tailored for a 610mm×455mm whiteboard, making it compact and suitable for classroom or office environments. The Foam cleaning pad provided effective cleaning without damaging the surface. The use of locally available components ensured cost-effectiveness, keeping the total budget under reasonable limits.

During testing, We wrote on the white board using a marker and conducted erasing tests immediately after writing and 10 minutes later, an even one hour later, through our observation, we found that there was no significant difference in the ease or effectiveness of erasing at these different time intervals. This consistency is likely due to the high-quality wiper material we used, which maintained effective cleaning performance regardless of the time elapsed since writing

Also, we wrote on the whiteboard using a marker and conducted erasing tests immediately after writing, 10 minutes later, and even 1 hour later. We observed that in the first test (immediately after writing), approximately 90% of the ink was cleaned in the first pass, and 100% was cleaned after the second pass. The same result was observed in the test conducted 10 minutes later. However, in the test conducted 1 hour later, slightly less ink was cleaned in the first pass—still around 90%—but complete cleaning (100%) was achieved after the second pass. In conclusion, in all three observations, our cleaning performance reached 100% within a complete cycle (two passes).

Overall, the project not only met its functional goals but also opened up avenues for future development. Enhancements like remote control operation, automatic start/stop using sensors, and aesthetic improvements could further refine the system. This project proves that even simple automation can significantly improve user convenience and productivity in real-world applications.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The design and development of the automatic whiteboard cleaner have provided an effective solution for simplifying the task of routine board cleaning. This project focused on a compact 610mm×455mm board, ideal for personal or small-scale educational and office environments. By integrating two DC gear motors, a metal support frame, plastic wheels, and a toggle switch-based control system, the cleaner offers a straightforward mechanism that performs reliable side-to-side cleaning.

The system operates by converting rotary motion from the DC motors into linear motion, moving an attached eraser across the board's surface. The toggle switch allows users to easily start or stop the cleaning process, making it highly accessible and user-friendly for non-technical users. The cleaner travels steadily across the board, ensuring uniform contact and consistent cleaning performance.

From a mechanical standpoint, the structure is lightweight yet sturdy enough to support the moving frame. The use of gear motors ensures controlled speed, while the 65mm plastic wheels and steel track provide a guided path with manageable friction. Frictional analysis and speed calculations confirm that the system performs reliably under moderate loads and surface conditions.

Despite its simplicity, the device demonstrates how basic engineering principles can be applied to automate everyday manual tasks. The project also encourages students and developers to think critically about motion control, mechanical linkages, and user interaction in designing real-world solutions.

However, the system is not without limitations. It lacks automation features such as programmable cleaning cycles, obstacle detection, or return-to-home functions. Additionally, its current design only supports unidirectional horizontal movement, leaving corners and edges less thoroughly cleaned. Nevertheless, the foundational design opens opportunities for further enhancements in functionality and control.

Overall, this project successfully:

- Demonstrates mechanical automation in a practical application
- Reduces manual effort in whiteboard cleaning

6.2 RECOMMENDATION

Based on the design, performance, and observed limitations of the automatic whiteboard cleaner, several recommendations can be made to enhance its functionality, usability, and applicability for broader use case Integration of Microcontroller (e.g., Arduino)

Incorporating a basic microcontroller can allow for:

- ✓ Automated start/stop sequences.
- ✓ Timer-based operation or scheduled cleaning
- ✓ Control via remote, app, or sensors.

Bidirectional Motion:

Implementing a motor reversing circuit or H-bridge motor driver would enable the cleaner to:

- ✓ Move in both directions automatically.
- ✓ Return to the starting point without manual reset.
- ✓ Support full-cycle cleaning.

Speed Control:

- ✓ Adding a motor speed controller (PWM-based) would allow:
- ✓ Adjustable cleaning speed based on user preference or board condition.
- ✓ Smoother operation and better adaptability for different environments

Limit Switches or Sensors:

Installing limit switches at both ends of the track would:

- ✓ Automatically stop or reverse the motor at the board edges.
- ✓ Prevent damage from overrun.
- ✓ Improve system reliability and safety.

Modular and Scalable Design:

Design the system to fit various board sizes:

- ✓ Adjustable frame length for compatibility with different dimensions
- ✓ Detachable components for easy transport and maintenance

Rechargeable Power Supply:

Use a rechargeable battery pack instead of direct power:

- ✓ Increases portability and eliminates the need for continuous wiring.
- ✓ Makes it safer for classroom or mobile use

By implementing these improvements, the automatic whiteboard cleaner can evolve from a basic mechanical prototype into a smart, efficient, and more widely applicable product suitable for commercial or institutional use.

REFERENCES

[1] Auto Eraser, “Whiteboard Cleaning Robots,” Auto Eraser Official Website, [Online]. Available: https://www.autoeraser.com

[2] Wiprboard, “Automatic Whiteboard Cleaner,” Wiprboard Product Page, [Online]. Available: https://www.wiprboard.com

[3] M. Smith et al.,“Development of an Automated Whiteboard Eraser Using Arduino,” International Journal of Robotics and Automation, vol. 8, no. 2, pp. 45–50, 2020.

[4] A. Rahman and N. Patel,“Magnetically Actuated Board Cleaning Robot,” Proceedings of the Undergraduate Research Conference, 2019.

[5] ASTM A653 / A653M – 22, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*, ASTM International, West Conshohocken, PA, 2022.

[6] https://www.chegg.com/homework-help/questions-and-answers/purpose-measure-coefficient-static-kinetic-friction-household-objects-equipment-table-plan-q59482315

[7] https://publisher.uthm.edu.my/periodicals/index.php/peat/article/view/14663/4975

[8] https://www.ajol.info/index.php/afrrev/article/view/104269

[9] https://jurnal.iicet.org/index.php/sajts/article/view/565/521

[10] https://www.scribd.com/document/805847047/Design-and-Constructgion -of Automatic-White-Board-11

[11] https://www.scribd.com/document/634266439/Smart-Whiteboard-Cleaner-For Effective-Cleaning-Mechanism-Using-Arduino-and-IR-Remote-Control

[12] https://www.scribd.com/document/427669501/Report-on-Blackboard-Cleaner

[13] https://www.neliti.com/publications/601061/automatic-whiteboard-cleaner

[14] https://jurnal.iicet.org/index.php/sajts/article/view/565

[15] https://www.ijser.org/researchpaper/Design-and-Development-of-an-Automatic-Board-Cleaner.pdf

[16] *Automatic Whiteboard Cleaner Using Arduino and Motorized Mechanism* Authors: S. K. Shinde, A. V. Patil, V. S. Patil, R. S. Patil. Available: https://www.ijraset.com/fileserve.php?FID=16139

APPENDIX A:

Tables-

Coefficient of friction for a range of material combinations

combination	Static		Dynamic	
	dry	lubricated	dry	lubricated
steel-steel	0.5...0.6	0.15	0.4...0.6	0.15
copper-steel	-	-	0.5...0.8	0.15
steel-cast iron	0.2	0.1	0.2	0.05
cast iron - cast iron	0.25	0.15	0.2	0.15
friction material - steel	-	-	0.5-0.6	-
steel-ice	0.03	-	0.015	-
steel-wood	0.5-0.6	0.1	0.2-0.5	0.05
wood-wood	0.4-0.6	0.15...0.2	0.2...0.4	0.15
leather-metal	0.6	0.2	0.2...0.25	0.12
rubber-metal	1	-	0.5	
plastic-metal	0.25...0.4	-	0.1...0.3	0.04...0.1
plastic-plastic	0.3-0.4	-	0.2...0.4	0.04...0.1

The coefficient of friction between two materials in relative sliding may depend on contact pressure, surface roughness of the relative harder contact surface, temperature, sliding velocity and the type of lubricant whether the level of contamination. It's the reason that the data found in the many reference tables available may show a large variation.

Table 1 Friction Coefficient Range Table

In our Project Plastic wheel moving on Metal Channel and its dry condition.
Due to these conditions,
We use as friction co efficient **0.2**

Where 0.2 average of limit 0.1 to 0.3