

Automatic Classroom Board Wiper

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Abstract

The manual system of writing and erasing boards in the classroom is a slow way of taking time and causes unproductiveness in the classroom, particularly in the institutions that have more than one session in a day. Also, chalk dust can be exposed to the teachers during frequent hand erasing causing respiratory problems and allergies. In an attempt to alleviate such problems and ensure that the education sector is automated, this project outlines the design and implementation of an Automatic Classroom Board Wiper system. A limit switches or Hall effect sensors are used to detect the limits of the board and as a result the system is able to switch direction automatically. A push-button switch, remote control or a timer-based automation system is the initiator of the operation.

Keywords- Automatic Classroom Board Wiper, Board Cleaner, Automation, Timer-based System

1. Introduction

Educational facilities continue to utilize blackboards and whiteboard as the main learning tools even with the emergence of the digital screens and smart classes. These boards must be clean at all time and there should be no obstruction to the learning process. Presently this is being done manually by the use of a duster or cloth which does not only waste precious teaching time, but also the teachers and the students are exposed to dust particles particularly when it comes to chalkboards. Chalk dust due to excessive exposure to it has been associated with respiratory issues, eye irritation and allergic reactions especially in poorly ventilated classrooms.

The Automatic Cleaning Board Wiper will solve these problems by automatizing the cleaning up of the board which leads to saving of time, less physical exertion and health risks are minimal. Educational Efficiency- Automation of board cleaning will make full use of teaching time to allow a greater transition

between lessons or classes. Health and Hygiene: Minimizing chalk dust exposure has the positive effect of promoting a safe and clean environment not only to the teachers but also to the students. Inclusivity: Physical handicapped teachers or users who happen to be allergic to dust find it advantageous not to clean boards by hand.

Technological Improvement: The project is a part of the continuous trend of automating the educational setting, as well as increasing the motivation students have towards applied electronics and mechatronics. With the increasing use of smart education tools, an automatic board wiper is a relatively inexpensive, convenient way of moving toward semi-automated classrooms, at least in the schools that cannot afford full scale smart boards. This project will entail the design, development, and execution of a motorized system that has the capability of wiping an ordinary classroom board (black board or white board) automatically. Safe and reliable, built-in limit

detection as well as obstacle avoidance should it be required.

2. Literature Survey

Mohanavel *et al.* proposed a system titled “Modeling and Fabrication of Automatic Blackboard Dust Cleaning System”, published in *Procedia Engineering (Elsevier)*[1]. The authors developed a motor-driven linear wiping mechanism capable of cleaning the entire blackboard surface. Their study emphasized reduction in manual labor and cleaning time; however, the system lacked dust collection and intelligent feedback mechanisms.

Akpeti presented “Development and Fabrication of an Upgraded Automatic Classroom Board Cleaner” in the *AEDT Journal of Engineering*[2]. The research focused on improving mechanical stability and operational simplicity. Although the design showed improved reliability, the cleaner operated on fixed motion paths without selective or sensor based cleaning.

Sharma and Patel designed “Design and Fabrication of Automated Board Cleaner”, published in the *International Research Journal of Engineering and Technology (IRJET)*[3]. The system used an Arduino Uno microcontroller and DC motors to move a duster along guide rails. The authors demonstrated a cost-effective solution suitable for educational institutions, but issues such as dust dispersion and lack of automation intelligence remained unresolved.

Kumar, Verma, and Singh presented “Automatic Classroom Board Erasing System” in the *International Journal of Scientific Research (IJSR)*[4]. Their work utilized push-button controls for motor operation. While effective for basic automation, the system required manual intervention and did not include obstacle or boundary detection.

Mehta *et al.* proposed a “Microcontroller-Based Automatic Blackboard Cleaning System” published in the *International Journal of Research in Engineering and Science (IJRES)*[5]. The system incorporated limit switches for directional control. Although the design enhanced safety and repeatability, no analysis was provided on dust-related health impacts.

Houpt developed “Automated Whiteboard Eraser” as a final-year project report at Washington

University[6]. The system relied on timed motor control rather than sensor feedback, reducing adaptability to various board sizes and cleaning requirements.

Li and Chen introduced “Design of a Remote-Controlled Chalkboard Eraser”, published in the *SCIRP Conference Proceedings*[7]. The use of remote control provided flexibility; however, the system did not achieve full automation since user involvement was still required for operation.

Health-related concerns due to chalk dust were discussed by Gupta and Rao in “Health Impacts of Chalk Dust Exposure in Classrooms”, published in the *Journal of Environmental Health Studies*[8]. Although no hardware solution was proposed, the study strongly justified need for automated board cleaning systems to minimize respiratory issues among teachers and students.

In addition, project-based implementations such as “Automatic Classroom Board Cleaner” documented by Nevon Projects[9] demonstrate practical applications of electromechanical cleaning systems. These implementations focus mainly on functionality rather than research-driven optimization.

3. Methodology

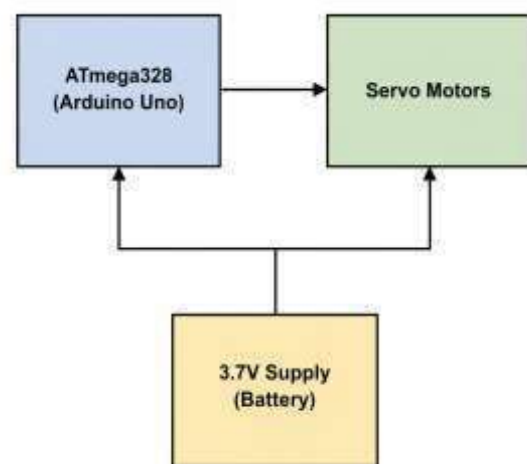


Fig:1 Block diagram of automatic classroom board wiper

The operation of the automatic classroom board wiper needs the basic mechanical and electronic parts. The materials needed are mainly a DC motor to give the system movement, a microcontroller

(Arduino or others) to control the system, and a motor driver (L298N) to control the movement of the motor. The motion of the wiper on the board is provided by a belt mechanism. however, A little noise caused by the motor and low efficiency when the duster is not well maintained. Microcontroller was used to control the direction and speed of the wiper and bring about uniformity in the performance. It took shorter time to clean than the process of manual wiping which enhances classroom productivity and lessens interruptions during lessons.

A white board wiper that was automated using DC motors and control circuits was developed. The system has a push button and cleans the board automatically eliminating the use of human labor and saves time. A research on automatic whiteboard cleaner with microcontroller and Wi-Fi presented a system that was managed by using a mobile application. It enables forward, backward and stop functions and makes cleaning process flexible and able to be controlled remotely. A different study suggested an automated cleaner using rack-and-pinion; in which an engine-powered car moves the duster over the board surface. This eliminates distraction in lecture sessions and enhances the teaching process.

An overview of the automatic blackboard cleaner systems has emphasized the application of the mechanical and motor-driven design to reduce the number of people working on it and the health complications presented as a consequence of exposure to the chalk dust. The latest publications on automatic green board cleaners are concentrated on the increase of efficiency, safety, and optimization of design. Such systems are supposed to make the classrooms dust free and more usable. Implementation on arduino has also been suggested whereby the system would automatically go around the board and then turn itself round so that no spots would be left.

When the device is powered on, it initializes all modules and waits for a user command. Upon pressing the start button, the microcontroller activates the motor via the driver, moving the cleaning carriage horizontally. As the carriage wipes the board, sensors continuously monitor boundaries and obstacles. When the carriage reaches the end, it reverses direction. After completing one or more passes, the carriage returns to the home position and

stops. LEDs indicate status, and safety routines ensure protection from faults.

The automatic classroom board wiper systems have been designed in such a way that they cut on manual work and save time as the teacher teaches. The majority of the designed models engage DC motors and low-tech mechanical processes to actuate the wiper over the board. There are systems that are controlled by push-button controls and more sophisticated systems that have microcontrollers such as Arduino and Wi-Fi modules that can be operated remotely by mobile applications. Rack and pinion are some of the common mechanisms that are used. These systems assist the teachers to proceed with lectures without any pause and also curb any health problems that come about due to chalk dusts in the traditional blackboards.

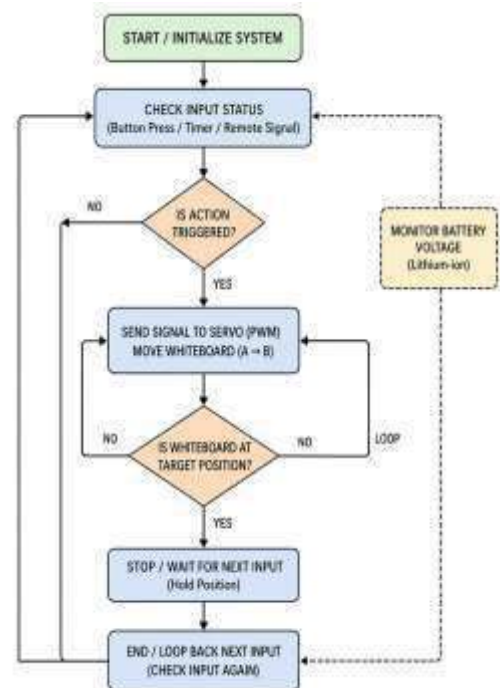


Fig:2 Flowchart of automatic classroom board wiper.

4. Results and Discussion

The automatic classroom board wiper was designed successfully and tested to clean the board effectively without the manual labor. The system could move the wiper around the board with the help of a motor-driven mechanism that would help the board to be cleared of the content of the chalk or marker. Microcontroller was used to control the direction and speed of the wiper and bring about uniformity in the performance. It took shorter time to clean than the

process of manual wiping which enhances classroom productivity and lessens interruptions during lessons.

Testing revealed that the system worked reliably and evenly when cleaning was done, particularly with correct alignment and pressure of the duster. It was also used to minimize the direct contact with chalk dust which is healthy. There were however, few shortcomings including power supply dependency, a little noise caused by the motor and low efficiency when the duster is not well maintained. It is triggered by a push-button switch, remote control or a timer based automation system. The wiping surface is comprised of soft microfiber or foam textile, which is efficient in removing the remnants of chalk or marker without harming the board. The project is part of the expanding area of automating the classroom, and it should ease the workload of the teacher without teaching anything. It can be also optimized with the support of voice control, smartphone apps, or the AI-powered scheduling systems. The prototype is low priced and can be implemented in schools, colleges and training centers and in those places where automation is not always as accessible but is needed to enhance hygiene.



Fig:3 Demo of the Automatic classroom board wiper

5. Conclusion

The Automatic Classroom Board Wiper project will be an innovative and feasible way of solving one of the most widespread yet not the most widely discussed issues in educational settings manual cleaning of classroom boards. Historically, students or teachers had to wipe the board with a duster which is time consuming, disrupts the teaching process and exposes the people to chalk dust or find the remnants of markers..

This project also exhibits cost-effectiveness and the ability to implement it easily. The component

materials (motors, microcontrollers (as Arduino), and simple structural components) are easy to obtain and cheap. This renders the system to be adopted in schools and colleges that have low budgets. Nevertheless, the project can be improved in the future to a great extent despite these limitations. More complex applications like sensor-based automation can be integrated, customized cleaning programs, and integrated with smart classroom systems to be better functionalised. To illustrate, the sensors are able to tell the dirty board and automatically turn on the cleaning mechanism. Remote control may be enabled by wireless technologies such as Bluetooth or Wi-Fi with the help of mobile applications. Moreover, better design can be done to reduce noise and provide more durability. To sum it up, the Automatic Classroom Board Wiper project manages to achieve its goal of offering a clean, convenient, and efficient cleaning product to clean the board in the classroom.

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