# Embedded Based Automatic Board Clean Robot

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*Abstract* - **The project aims to develop an automated board cleaner to reduce teaching time and increase lecture delivery time. The construction and model were validated using manual and AutoCAD software, using components like whiteboards, dusters, frames, rods, lead screws, servo motors, bush, switch and copper wires, IOT modules, and AI integration. The designing and engineering of an automated board cleaner have been published to incorporate a new advanced mechanism for erasing the board. In earlier projects, the erasing mechanism faced challenges in achieving its full efficiency in terms of reducing erasing time and thereby maximizing lecture length. The explanation for this was that if the lecturer wrote a small word on the paper, the duster would delete the whole board, not just that part. This automation system enhances the quality of smart classrooms and reduces the workload for board users.**

*Keywords - IoT, AI, AutoCAD, Servo motors, Bush.*

## I. INTRODUCTION

In classrooms, meeting rooms, and other educational or professional settings, boards play a crucial role in facilitating communication and learning. However, these boards can quickly become covered in chalk dust, marker residue, or other contaminants, which can affect readability and visual clarity.

Cleaning these boards manually can be time-consuming, and it may not always result in a perfectly clean surface. The Automatic Board Clean Project addresses these challenges by introducing an automated solution that combines various technologies to clean boards effectively. This project leverages the advancements in robotics, sensors, and control systems to create a device capable.

## II. LITERATURE REVIEW

It is a technique that is often used to automatically wipe the whiteboard with the help of a duster. We can save time and energy by using this automated process. This project intends to create a boar cleaning system with a motorized wiper to control the total mechanism in a reciprocating motion, with control accomplished by attaching a battery for an external power supply. The duster attachment moves in a reciprocating manner thanks to the lead screw[1].

A whiteboard or dry-erase board is a name for a glossy surface, most commonly colored white, where non-permanent markings can be made. Whiteboards operate analogously to chalkboards in that they allow markings to temporarily adhere to the surface of the board. The popularity of whiteboards increased rapidly in the mid-1980s and they have become a fixture in many offices, meeting rooms, school classrooms, and other work environments[2].

Education is the backbone of a nation. Education comprises teaching and learning. The resources and materials used in teaching are updated along with the teaching and learning techniques. The writing was earlier done on the sand, walls, slates made out of wood, chalkboards, and in recent times on whiteboards and electronic boards. Chalk dust scatter causes serious health problems. Because of these reasons, the whiteboard has been widely implemented in many other sectors of human endeavor besides teaching[3].

Due to ghosting on the whiteboard only the surface dust is removed when it is erased conventionally (Ill no is tool works Inc., 2006). Chemically synthesized surfactants are derived from petrochemical sources and these compounds have been extensively developed for large-scale industrial applications, mainly in the area of products such as detergents and surface cleaners[4].

Whiteboards are also similar to chalkboards, allowing rapid marking and erasing of markings on the surface. The use of whiteboards in learning environments can affect learning in many ways, including raising the level of interaction in a classroom, inspiring students,

and stimulating eagerness for learning[5].

When we say teaching and learning process we will focus on the teacher and student, who is the person delivering and receiving information and knowledge. How do they deliver their knowledge to students? Nowadays, there are many methods which are used by teachers to deliver their knowledge such as computer, notes given by the teacher, and last but not the least whiteboard or blackboard as a medium to deliver the information to students. The invention of blackboards was a revolutionary change in the history of mankind which led to the development of society. One of the problems we are experiencing in our classroom is erasing the blackboard[6].

Furthermore, the user-friendly design of the LCD screen extends its utility beyond a mere display interface. With the ability to present graphics, the screen can enhance the shopping experience by providing visual aids such as product images, promotional content, or even a dynamic map of the store layout. This graphical feature adds an extra layer of engagement and convenience for users navigating through the shopping environment[6].

This type of cleaner moves horizontally using a motor mechanism and erases the board with the help of dusters attached to it but it cannot create sufficient pressure on the board. The friction produced between fixed dusters and rolling surfaces creates sufficient pressure to erase the written data on it but this process is too time-consuming to clean the board[7].

The chalk dusts are inorganic and contain tiny solid particles scattered or suspended in the air. The chalk particles that evade elimination in the nose or throat tend to settle in the sacs or close to the end of the airways, but if the amount of dust is large, the macrophage system may fail[8].

Because of the growth of educational institutions and the desire for 100% literature, chalk and blackboard usage has been rising over the last several decades. Blackboard instruction seems to help achieve this learning outcome. The duster is used to clean the blackboard[9].

A microcontroller-based handy free duster for the classroom, a device that is generally used to clean board without human intervention. It is a new expertise that is normally used to keep time and energy. A device for automatically erasing a blackboard where a duster is mounted for a longitudinal moment on the blackboard and has a

motor mounted there on that is interconnected to a drive assembly for producing the moment of the duster in an erasing operation[10].

## III. PROPOSED METHODOLOGY

The proposed system aims to be an embedded-based automatic board cleaning robot is a specialized robotic system designed to clean or maintain electronic circuit boards and similar surfaces.

It typically involves a combination of hardware components and embedded systems to perform its cleaning tasks efficiently. Here's a high-level overview of the proposed system. The project aims to Embedded Based Automatic Board Clean Robot is used to clean the board.

In this, we are going to implement the Vacuum cleaner to avoid the dust from chalk. operate it through both PC and Mobile and then can be operated by the physical interface integrated into it. The project aims to develop an automated board cleaner to reduce teaching time and increase lecture delivery time.

The construction and model were validated manually and a combination of sensors, actuators, Sensor Array, Actuation Mechanism, Control Unit, User Interface, Safety, Features and Intelligent control algorithms were to achieve efficient and precise cleaning. This automation system enhances the quality of smart classrooms and reduces the workload for board users.
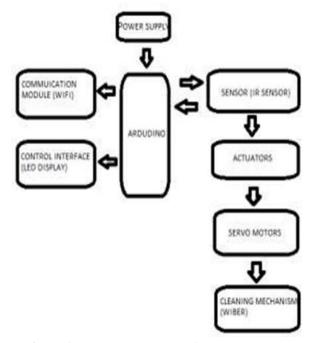


**Figure 1.** Schematic Diagram of Proposed Method

*Arduino Uno*

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which can be used as PWM outputs), analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform for an extensive list of past or outdated boards see the Arduino index of boards. Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, "Uno" means some in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, which now evolved to newer releases. The Arduino/Genuine Uno board can be powered via a USB connection or with an external power supply. The power source is selected automatically.

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. IOREF This pin on the Arduino/Genuine board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

*A.* IR Sensor

An infrared sensor is an electronic device that emits light to detect some object in its surroundings. An infrared sensor can detect motion as well as measure the heat of an object. Generally, all objects in the infrared spectrum emit some form of thermal radiation. These types of radiation are invisible to our eyes, but an infrared sensor can detect them. The emitter is simply an infrared LED (Light Emitting Diode), and the detector is simply an infrared photodiode. The photodiode is sensitive to IR light of the same wavelength as the IR LED. When IR light strikes the photodiode, the resistances and output voltages change in proportion to the magnitude of the IR light received.

*B.* Delay Timer Switch

The timer switch relay module has an adjustable timer delay (default setting: 0-10s) and a counterclockwise potentiometer adjustment to increase the delay period. High dependability, high vibration resistance, and excellent electromechanical performance. Timing from microseconds to length hours, easy circuit design, high pulse generation/timing precision, flexible duty cycle, wide application range, and a large amount of information are all features of the Ne555 chip.

*C.* Wiper

Wipers are a vital safety feature that helps to keep your windshield clear of rain, snow, and other debris. They are made up several components, including the wiper motor, wiper arms, wiper blades, and wiper linkage.

wiper motor is an electric motor that is responsible for powering the wiper arms. It is usually located under the hood of the car, near the firewall. The wiper arms are attached to the wiper motor by a linkage system. This linkage system converts the rotational motion of the wiper motor into the back-and-forth motion of the wiper arms. The wiper blades are attached to the ends of the wiper arms.

They are made of a rubber material that helps to remove rain, snow, and other debris from the windshield. The wiper linkage is a system of gears and levers that connects the wiper motor to the wiper arms. It is responsible for converting the rotational motion of the wiper motor into the back-and-forth motion of the wiper arms. When you turn on the windshield wipers, the wiper motor starts to rotate. This rotation causes the wiper arms to move back and forth across the windshield. The wiper blades then wipe away any rain, snow, or other debris that is on the windshield.

The speed of the windshield wipers is usually adjustable. You can adjust the speed of the wipers by turning the wiper control knob on the steering wheel. Windshield wipers are a very important

safety feature. They help to keep your windshield clear so that you can see the road ahead. It is important to keep your windshield wipers in good condition by replacing the wiper blades regularly and checking the wiper linkage for any signs of wear and tear.

Shaft

A drive shaft is a mechanical component used to transmit torque and rotation. It is typically used to connect other components of a drive train that cannot be connected directly due to distance or the need to allow for relative movement Made up of mild steel.

D. Bearing

Bearings are one of the most used machine parts because their rolling motion makes almost all movements easier, and they help reduce friction. The design of the bearing may allow for free linear movement of the moving part or free rotation around a fixed axis, or it may prevent a motion by controlling the vectors of normal forces bearing on the moving parts. Most bearings make the desired motion easier by reducing friction.

E. Arduino Software(IDE)

The Arduino Integrated Development Environment (IDE) is a software platform used to write and upload code to Arduino-compatible boards. It provides a user-friendly interface for programming microcontrollers, making it accessible for both beginners and advanced users in the world of electronics and embedded systems. At its core, the Arduino IDE features a text editor where users write code in the Arduino programming language, which is a simplified version of C/C++. It also includes a compiler that translates this code into machine language instructions that the Arduino board can understand. One of the key features of the Arduino IDE is its extensive library of pre-written code, called sketches, which users can utilize to quickly implement various functions without needing to write code from scratch. Additionally, the IDE supports third-party libraries, enabling users to expand the capabilities of their projects with additional functionality.

Furthermore, the Arduino IDE offers a straightforward process for uploading code to Arduino boards via a USB connection, making the development and testing of projects seamless and efficient.

IV. RESULT

The Embedded-Based Automatic Board Cleaning Robot is a specialized system with a vacuum cleaner for efficient board cleaning. It operates remotely via PC and mobile and has a physical interface. Utilizing a sensor array, actuation mechanism, and intelligent control, it enhances smart classrooms, reducing teaching time and worked for users.
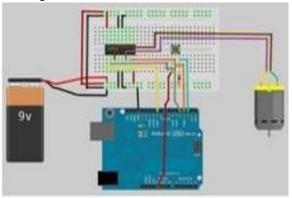


Figure 2. Circuit of the Proposed System

V. CONCLUSION

The Embedded-Based Automatic Board Cleaning Robot presents a technologically advanced solution to efficiently clean electronic circuit boards, contributing to enhanced smart classrooms. With remote operation options, a sensor array, and intelligent control, the system reduces teaching time and user workload, emphasizing its potential for widespread implementation and positive impact on educational environments.

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