Automatic White Board Cleaner

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Abstract— In the teaching field, whiteboard, duster, and marker are crucial elements. To erase the writings from large size boards manually with a duster is a time-consuming task. It breaks the concentration of both lecturers and listeners. This paper represents the design and construction of automatic whiteboard cleaner. The system consists of a microcontroller, wi-fi module, DC motor, driver module, wooden shaft, electrical switch, and mobile. This application is developed to remotely control the operation. Using the mobile phone, an android application developed which consists of buttons to move the shaft in a forward and backward direction and to stop it. The Automatic whiteboard cleaner reduces the time and efforts required.

Keywords— Automation, whiteboard, cleaner

I. INTRODUCTION

In teaching and learning process, the main focus is on teacher and student, delivering and receiving information and knowledge. Nowadays, there are many methods which are used by teachers to deliver their knowledge such as a computer, note but not the least whiteboard or blackboard as a medium to deliver the information to students. One of the problems we are experiencing in our classroom is erasing the blackboard. Chalk is a composite of calcium carbonate and it looks like a stick. It was comfortable but it creates dust during wiping the board using the duster. A duster is a device which is used to wipe the writings from the board. Though the blackboard has not lost its popularity as in present time and it's being used widely across the world. Chalkdust scatter causes extreme nuisance especially for people who have asthma, skin irritation, and serious health problems.

Blackboards require a lot of time to get rubbed which increase the demand for whiteboards. The first whiteboards were very expensive and were made of enamelled steel but seeing the growing demand in the market cheaper whiteboards made of steel with polyester or acrylic coating of white color on it was launched. Here a marker pen is used as pen medium and as duster a piece of cloth or a foam duster. As the whiteboard has the advantage of not creating the dust as it only makes the duster dirty and it is very much comfortable using marker pen as it comes in different colors. Across the world now the whiteboard is the best writing medium. Different types of whiteboards like laminated chipboard, high-pressure laminated boards, and porcelain boards were launched in the market for cheaper

alternatives. Now almost everything is automated and the automation system has the capacity to reduce the human effort and to make any arrangement easier. Modifications were also done in cleaning and rubbing methods of whiteboards. Remote control motorized cleaners were innovated to reduce the human efforts required for cleaning. This type of cleaner is operated by motors and is controlled by the switch.

In this paper, Part II describes the Related Work where several previous works have noted. The methodology is explained in Part III of the paper which introduces the different elements of the automatic whiteboard cleaner like NODEMCU, DC motor, motor drivers. Part IV of the paper describes the Results & Discussion. Then we conclude the paper along with future scope in Part V. Acknowledgement and References are shown at the end of this paper.

II. RELATED WORK

Sonia Akhter and Moudud Ahmad [1] overcome the problem erasing with a system in which only one motor and driver with rack and pinion mechanism are used instead of belts and a large amount of pressure has provided by rack and pinion mechanism with necessary supports.

S.Joshibaamali And K.Geetha Priya [2] explained that the cleaning process in three steps as first it cleans the left side of the board, second, it cleans the right side of the board and in the third mode, it cleans the whole area of the board. The machine uses two stepper motors to move duster in horizontal (x-axis) and vertical (y-axis) direction. To move the duster in up and down direction linear motor is used. The infrared transceiver is used to detect the horizontal direction

of the motor. Four limit switches are used to detect the boundary of the board.

Mr. Sunil R. Kewate et. al. [3] explained in their paper the design and principles of sliding type wipe mechanism and also carried out the implementation and experimentation for motion analysis. The mechanism automatically detects the blackboard chalk stains and erases the font. This system consists of two motors, three guide rails, and three sliders. S.nithyananth et. al. [4] has explained about rack and pinion mechanism with the application of steering mechanism. In the steering mechanism, the author is trying to tell that the rotational motion applied to pinion will cause the rack to slide up to the limit of its travel.

Dong Yeop Kim et. al. [5] proposed a limit switch module as a mechanical sensor method. In this system, there are two limit switches. Their combination is translated to building wall shape information. The ARS sensor and the height sensor are used to mapping to 3D localization of the robot. If ARS sensor and height sensor is attached to another place of the gondola, the sensor data is needed to send to this limit switch module process algorithm.

Mojtaba Khaliliana et. al [6] used a direct torque control technique to control the torque instantaneously and improve the performance of the hybrid stepper motor. Then by taking the model reference adaptive system scheme, which uses a hybrid stepper motor itself as the reference model, the speed of the motor is estimated. The sensorless control of a hybrid stepper motor based on MRAS with Matlab software is built and simulated. The results show that the control technology is simple and effective and accuracy is considerably high [7].

The electric board cleaner and the automatic whiteboard cleaner make 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 (i) conceptualization of an automated whiteboard cleaner (ii) preliminary and detailed design of new mechanism

(iii) Fabrication of the Preliminary Design of an Automated White Board Cleaner automated whiteboard cleaner.
(iv) Performance testing of the automated whiteboard cleaner.

III.　METHODOLOGY

The main aim of this project is to design and develop Automatic Whiteboard cleaning system using Microcontroller which can overcome the problems related to discomfort for the teacher, breaking concentration and conceptual link between lecturer and student and wastage of time and energy while erasing the board.
Objectives:
- To achieve a general understanding of the technology implicated in using automatic whiteboard cleaner in college.
- The written can easily clean and not a waste of time.
- To saves our valuable and precious time.
- To do cleaning work, merely by using an automatic board cleaner.
- Make a low cost and user-friendly whiteboard cleaning machine.

Outcomes:
- We will successfully clean the whiteboard automatically.
- We will operate this project from long distance by mobile.

We have attended many lectures on Power electronics, Digital communication, and Digital signal processing and so on. What we always say that teachers need to clean every corner of the board for plotting graphs and writing equations. Teachers more time and energy is wasted in cleaning the board during 60 minutes lecture. So students were getting bored, deviates from the topic and start chatting on mobile. The link of teaching is disturbed. So after cleaning board teachers need to pay more attention to students to get them on track again. This is a very difficult task to do. This motivated us to propose "AUTOMATIC WHITEBOARD CLEANER".

The mechanism of the automated board cleaner entails a horizontal motion. The duster which spans horizontally across the width of the board is to clean the board. The design is such that when the switch is turned on, the motor transmits energy which turns the shaft which in turn, drives the pulley. The duster is fixed to the pulley chains which move to and fro (horizontal motion) along its plane, thereby cleaning the board. The first command signal is given to NODEMCU. Then the voltage is given to DC motor through L298N motor driver. In the Arduino program, there is uploaded for DC motors rotation. After getting instruction from Arduino dc motors are rotate at speed by given instruction in the program. Motors are connected to a

mechanical shaft which has also cleaning material of duster is attached. After start rotating of motors in the path the shaft also moves and due to this the cleaning material of duster getting a move and it is closed to the whiteboard surface. So it cleans the written on boards.
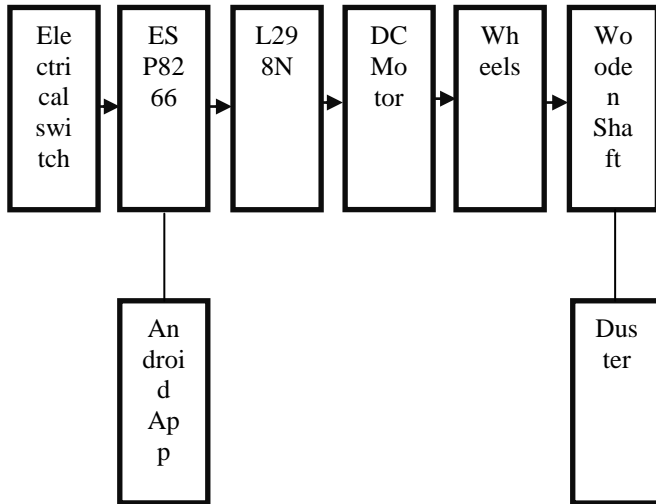
Fig 1. Block diagram of the proposed system

IV.   RESULTS AND DISCUSSION

It is observed that the time of complete cleaning of the board using this system is average 5.975 sec. On the other hand, while using the manual process the time of cleaning is about 25 sec which is about four times of the machine time. So proposed whiteboard cleaner takes less time than other previous models. It creates less noise than other motorized cleaners. Sufficient pressure has been induced during the operation due to the attachment of brush to the side reels of whiteboard which helps to clean the board very effectively and efficiently. Change of brush is very easy and it does not affect any other parts while changing. This system is only applicable to the whole board cleaning. Partial cleaning of the board is not possible through this system. Though there is some lagging in to start the motor, averagely it is optimum.

For controlling the positions of the shaft we have created an Android application called Mert-Arduino. We have used the platform called MIT App Inventor for the application development. The application has buttons such as forward, backward, and stops.

In the figure below forwarding, the operation is explained. Through the mobile application forward command is given and Shaft moves in the forward direction and motor running in a clockwise direction.

Fig 2. Forward State of erasing

If the command given through mobile application is backward, Shaft moves in the backward direction and motor running in the anti-clockwise direction.

Fig 3. Backward State of erasing

As and when stop button in the mobile application is pressed, the motor stops at the current position due to this Shaft also stops suddenly.
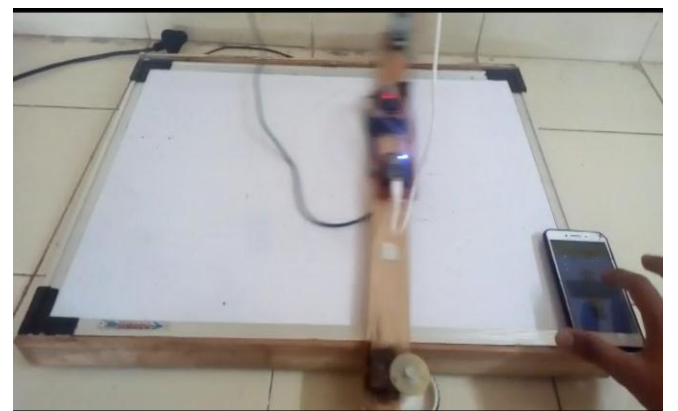

Fig 4. Stop condition of the system

V. CONCLUSION AND FUTURE SCOPE

The objective of this work which is to design an automated whiteboard cleaner has been achieved to an extent. There is a need for further fabrication works. The structures of the chains and sprocket were conceived to fit properly into the cleaning mechanism, but due to inadequate tensioning, prevented the automated duster from performing the required function adequately. The gear mechanism could have been used to reduce the speed of the motor, but considering the weight which it might have on the machine, variable speed regulators were inculcated instead. Due to the forward motion of the duster, the sensor was needed to trigger off the motor whenever the duster gets to the end of the board. This can be used to prevent damage to the motor. Finally, the automated duster when fully completed will give effective cleaning after two to three sweeps. It is recommended that the machine be improved in terms of tensioning of the chains to ensure effective cleaning and that rollers are placed at the base just in front of the duster, creating a groove where it can move. Finally, proper fitting of bearings on the sprocket is put in place to reduce the load on the electric motor`.

It is concluded that automatic whiteboard cleaner has successfully designed. The system was designed with innovative features which reduces human efforts and makes teaching efficient. This type of whiteboard could be very effectively used in schools, colleges, and universities as it increases the interest of the students to study with different technology. The machine has reduced both time and human effort. The construction of automatic whiteboard cleaner consists of Arduino microcontroller which is very user-friendly in programming. On the other hand, to construct the main structure, very simple tool work is needed, and the material used in this project is cheap and easily available in the market. So it is not complicated to construct this machine and it will help to introduce an automation system. The system can be further developed by integrating a Bluetooth remote for controlling the switch. Infrared sensors can be used to convert this system to a smart whiteboard. Aesthetic looks of the whiteboard can also be improved.

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