IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 6, Issue 9, September 2018

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

M.Suresh[1], Dr.R.Meenakumari[2], Dr.P.S.Raghavendran[3], V.Gowrishankar[4], P.Karthikeyan[5], V. Surendar[6], C. Jagan[7], N. Krishna Prashant[8]

Assistant Professor, Department of EEE, Kongu Engineering College, Perundurai, Tamil Nadu[1,4,5,6]

Professor, Department of EEE, Kongu Engineering College, Perundurai, Tamil Nadu[2]

Associate Professor, Department of EEE, Kongu Engineering College, Perundurai, Tamil Nadu[3]

Graduate Students, Department of EEE, Kongu Engineering College, Perundurai, Tamil Nadu[7,8]

Abstract: At recent years whiteboard has become a crucial element at almost every educational institute. They are large in size, for that reason it is very time consuming and tedious process to erase the writings from the board with duster manually. It breaks concentration of both lecturers and listeners. Automatic Whiteboard Cleaner can solve these problems. Automatic whiteboard cleaner will reduce the time and also the effort. This paper represents the design and construction of automatic whiteboard cleaner. The system consists of Arduino, relay, dc gear motor, supports and a cleaner bar to give that an automation figure. When the switch is on, it moves across the full width of the board and its direction is reversed automatically in order to clean the board. So, this "Automatic Whiteboard Cleaner" is a great replacement of "duster" and it can be suggested to use this to reduce the effort of the board user as well as to introduce the classroom with an automation system.

Keywords: Automation, whiteboard cleaner, Arduino, rack and pinion mechanism

I. INTRODUCTION

Education is the back bone of a nation. Education comprises of teaching and learning. The resources and materials used in teaching becoming updated along with the teaching and learning techniques. Writing was earlier done on sand, walls, slates made out of wood, chalkboards and in recent times on white boards and electronic boards. Chalk dust scatter causes serious health problems. Because of these reasons white board has been widely implemented into many other sectors of human endeavour besides teaching.. Many variations had been done on cleaning of whiteboard surfaces. Remote control motorized cleaners are made in which the dusters are operated with the help of remote control. This type of cleaner moves horizontally by means of motor mechanism and erase the board with the help of dusters attached to it but it could not create sufficient pressure on board. This limitation was solved by using rolling whiteboard surface and fixed dusters. Instead of moving the dusters the whiteboard surface is moved around the rollers. The friction produced between fixed dusters and rolling surface creates sufficient pressure to erase the written data on it but this process is too time consuming to clean the board. This drawback was overcome by using microcontroller and sensors but the longevity of board is short because it acts as flat belt. Remote control motorized cleaners makes use of belts which have low wear and tear resistance and with the frequent operation of cleaning process, the belt is likely to cut and hence makes the device or the cleaner less useful. Instead of belt, chain had been used to improve the cleaning procedure but it creates too much noise. Using cord and pulley arrangement the wiper bar connected to the motors can erase writings on the board which creates less noise but it requires four motors and two motor drivers causing too much cost. These limitations have been overcome by the proposed design in this paper. Arduino is using for wireless control and it helps in quick process.

II. SYSTEM COMPONENTS

This system is designed considering the present scenario of white boards. It consists of seven main components. They are dc gear motors, Arduino UNO, motor driver, four channel relay, duster holders, dusters, rack & pinion, node MCU, white board surface made up of acrylic sheet, mobile application (blynk) and limit switch.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 6, Issue 9, September 2018

III. DESIGN OF SYSTEM COMPONENTS

The whole system is based upon two individual units. One is the cleaning unit which ensures to erase writings and other is the controlling unit which controls the cleaning system. The cleaning unit consists of the necessary arrangement which enable the cleaner slide over the board and the controlling unit consists of Arduino which controls the motor, and the time of rotation.

IV. DESIGN OF CONTROLLING UNIT

At controlling unit Arduino Uno is used which is a microcontroller board based on the ATmega328 .It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. One of its most important features is its ease of programmability.

Fig 1: arduino micro controller

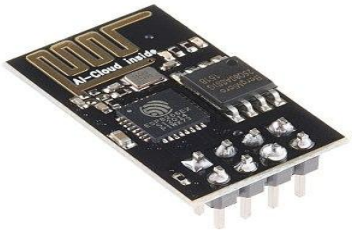

Fig 2: Wifi Module

Fig 3: Four Channel Relay

Fig 4: Limit Switcher

A dc gear motor is used at this project which can be operated within the range of 12V and has a speed of 200 RPM. The shaft length of motor is 25-30 mm and shaft diameter is 8 mm. This type of gear motors has high torque and produces very less vibration effect so that the pinion can rotate smoothly. AC to DC adapter is used to convert AC supply into DC supply. A 3.3V and 0.5 amps node mcu is used. It also consists of 5V 0.5amps four channel relay. In this system the converter is used to step down the 240V AC to 18V, 3 DC supply. The converter is required for functioning of DC gear motors because these motors work only on dc supply.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 6, Issue 9, September 2018

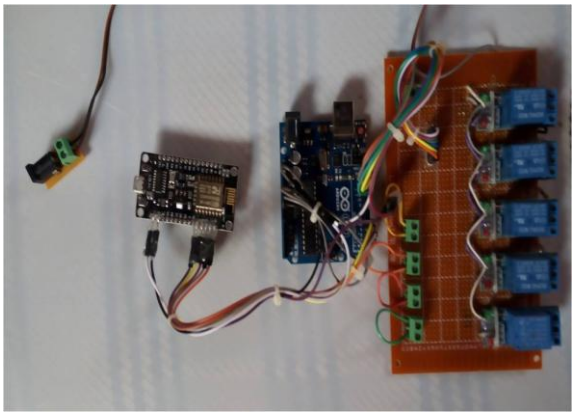

Fig 5: Controlling Unit

V. DESIGN OF CLEANING UNIT

Cleaning unit consists of two segments, consider x and y. The x is the vertical slider and y is the horizontal slider, both of them are attached with brush, The other main components are whiteboard, supportive board etc. Rack and pinion mechanism is used for motor motion either forward or backward . The pinion is coupled with the motor that means the pinion rotates with the shaft of the motor. The brush is an important part for this project. To clean the white board smoothly a brush of better quality has been used. It has attached to the brush holder with the help of glue & the brush holder is attached to the end of the rack with a nut & bolt. The whiteboard is enclosed within two reels. It is of length 60cm, breadth 5cm and height 30cm. It is used to support the whiteboard sheet at the time of writing.

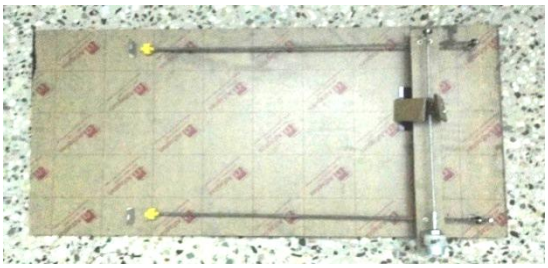

Fig 6: Cleaning Unit

VI. SIMULATION DIAGRAM

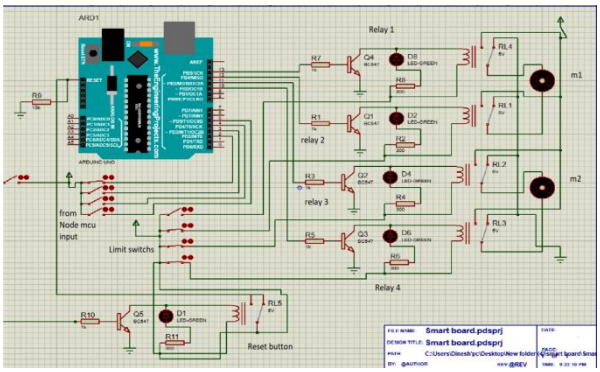

Fig 7: Design Of Main circuit Of Automatic White Board Cleaning

VII. CONSTRUCTION OF MAIN STRUCTURE

The system is assembled by using all the components as mentioned above. The slider holding the duster fixed in it are attached on backside of the white board. Two DC gear motor (12V and 200rmp) is fixed on the upper and lower side of the block with clamp. The rack is coupled with the motor that means the motor rotates along the rack. The rotary motion of the motor is transferred to the slider which produce linear motion for erasing the board. A brush has been attached to the brush holder with the help of glue & the brush holder is attached to the end of the rack with a nut & bolt.

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 6, Issue 9, September 2018

VIII. WORKING PROCEDURE

Now, considering the system is in use and the teacher wants to rub the board. When the teacher switch on the supply to the SMPS. 5V supply is given to the Arduino.

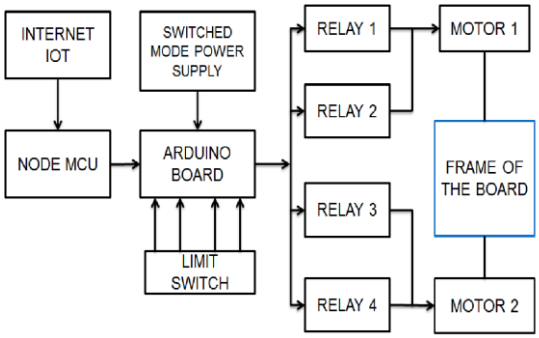

Fig 8: Working Circuit

The node mcu is used for controlling the board using IOT based mobile application (blynk).This ARDUINO provides signal to the relay at a specific time interval. To drive the motor four channel relays has been used. It receives the signal coming from the ARDUINO & for each motor 2 relays has been used, one for forward and other of reverse directions .Hence the motor rotates in both clock-wise & anti-clockwise direction. Due to the rotation of the shaft of the motor, the slider connected to it also moves which in turn produce motion on whiteboard. To clean the white board smoothly a brush of better quality has been used which is attached to the brush holder. one brush moves from the upper portion to the lower portion and other moves from right side to left side of the board .And get rubbed due to the friction between board surface and brush.

CONCLUSION

It is concluded that automatic whiteboard cleaner has successfully designed. The system has 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 materials used in this project is cheap and easily available in 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. Infrared sensors can be used to convert this system to a smart white board. Aesthetic looks of the whiteboard can also be improved.

REFERENCES

[1]. Tsado Jacob, "A Remote Controlled Motorized White Board Cleaner", AU Journal of Technology, Vol.15, No.4, pp. 273-280, 2012.
[2]. Praveen. G, "Microcontroller Based Automatic Electronic Duster", Proceedings Of International Academic Conference On Electrical, Electronics And Computer Engineering, pp. 10-13, 2013.
[3]. Puneet Mathuret. al., "Automated Motorized Whiteboard", International Journal Of Engineering, Business AndEnterprise Applications (IJEBEA), Vol.6, No.1, pp. 01-04, 2013.
[4]. Bhushan Tukaram Chougule and Puneet Mathur, "Automated Motorized Sensing Whiteboard", International JournalOf Advanced Research In Engineering And Technology (IJARET), Vol. 5, No. 3, pp. 155-163, 2014.
[5]. Simolowo and O. E., "Preliminary Design of an Automated White Board Cleaner", International Multidisciplinary Journal, Vol. 8 (2), No. 33, pp. 68-82, 2014.
[6]. Imam-Ul- Ferdous and A.H.M Fazle Elahi, "Development of an Automatic Board Cleaning system using Microcontroller", International Conference on Mechanical, Industrial and Energy Engineering 2014 (ICMIEE: PI-140307), Khulna, Bangladesh.
[7]. Chris Betcher and Mal lee, "The Interactive Whiteboard Revolution", Aust Council for Ed Research, pp. 10-12, 2009.
[8]. Suresh Muthusamy, Meenakumari Ramachandran (2016) "Economic Analysis of Solar PV/Wind/Diesel Generator/Battery Connected Integrated Renewable Energy Systems for Residential Applications" In: Kumar S., Khanal S., Yadav Y. (eds) Proceedings of the First International Conference on Recent Advances in Bioenergy Research. Springer Proceedings in Energy. Springer, New Delhi.
[9]. Hitesh Panchal, Kishor Kumar Sadasivuni, M. Suresh, Satyapal Yadav & Shivani Brahmbhatt (2018) Performance analysis of evacuated tubes coupled solar still with double basin solar still and solid fins, International Journal of Ambient Energy, DOI: 10.1080/01430750.2018.1501745.
[10]. Dhandayuthabaani P, Hemalatha M, Gowtham V, Suresh M. An improved Flyback inverter for photovoltaicapplications. Int J Adv Res Electr Electron Instrum Eng 2015;4:1239 – 43.