International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 4, Issue 4, April 2015

AUTOMATIC BLACKBOARD ERASER

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Abstract— **Automatic blackboard dusters are made so as to ease the tedious job of erasing blackboards by teachers or students. Chalk dust or the marker ink may prove hazardous to health to both the teacher as well as student. So to reduce such problems Automatic Blackboard dusters are one of the alternatives. The manual method of erasing has one more disadvantage 'TIME'. The time wasted during the blackboard erasing can be utilized for much better purposes like teaching or attendance. So by doing this we are simply making things better for ourselves and the future generation. We propose a system to interface the mechanical aspects of the mechanical erasing system with micro controllers so as to enhance it into automation rather than manual. We are using PIC micro controller to interface the board erasing mechanism.**

***Index Terms*— Automatic, Blackboard, Duster, Eraser, PIC**

INTRODUCTION

Since our childhood the day we entered school first thing we have seen are blackboards. They laid the basic foundations of our knowledge from the basic ABC's to what we learn even today. India being a country emphasizing on education since ages. But the chalks we use on blackboards or the markers on whiteboards need to be erased if next thing is to be taught. This black or whiteboard erasing method is a tedious job. So to reduce a little bit time and energy of the teachers who shall raise the next generation we have tried to design the automatic blackboard erasing mechanism. Basically it is a simple Duster attached on a vertical Shaft. The movement is done by the use of 2 DC motors and they can be controlled via switches given. The Duster shall be placed in the midsection of the board so to reduce time to move towards any side of the board easily. Thus the teachers will be able to erase 50% of the board easily.

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Final Stage

When you submit your final version, after your paper has been accepted, prepare it in two-column format, including figures and tables.

A. Figures

As said, to insert images in *Word*, position the cursor at the insertion point and either use Insert | Picture | From File or

1.1 Need of Project Work

According to a survey done by the Government of India we came to know that there are 71814 Pre-Degree/Junior Colleges/Higher Sec. Schools , 128370 High/Post Basic Schools,47600 Middle/Sr. Basic Schools, 748547 Primary/Jr. Basic, 436 Universities / Deemed Schools Universities, 25938 Colleges for Professional Education, 1914 Polytechnics in India. Thus we can clearly see how many blackboards are present in India making our project a big necessity in today's life. The study[1], Assessment of Airborne Fine Particulate Matter and Particle Size Distribution in Settled Chalk Dust During Writing and Dusting Exercises in a Classroom, was done by Deepanjan Majumdar, DG Gajghate, Pradeep Pipalatkar and CV Chalapati Rao of the National Environmental Engineering Research Institute in Nehru Marg, India.

The team weighed each piece of chalk before and after using it. They collected chalk dust from the air, and also the dust that fell on to a long sheet of paper laid over the base of the blackboard. Their experiment featured three kinds of chalk, one blackboard, an eraser, an aerosol spectrometer (to measure and record the amount of dust floating in the air), and a Cilas model 1180 particle-size analyzer.

The report explains that in schools that still use chalk, teachers brave the greatest direct risk: "During teaching, entry of chalk dust in the respiratory system through nasopharyngeal region and mouth could be extensive in teachers due to their proximity to the board and frequent opening of mouth during lectures and occasional gasping and heavier breathing due to exhaustion. As per current state of knowledge on particulate matter vis-a-vis chalk dust, it "may remain suspended in air for some time before settling on the floor and body parts of the teachers and pupils".

The scientists acknowledge that chalk and chalkboards these days are being replaced, in many schools, by whiteboards and other more modern, less intrinsically dusty technology. But chalk still enjoys wide usage in many countries.

The study, published in the journal Indoor and Built Environment, ruefully concludes: "Though real-time airborne chalk dust generation was found to be low in this study and did not contain toxic materials, chalk dust could be harmful to allergic persons and may cause lacrimation and breathing troubles in the long run and certainly is a constant nuisance in classrooms as it may soil clothes, body parts, audiovisual aids and study materials."
This in addition increased the importance of the project we are trying to build so as to decrease the discomfort caused due to chalks.

2. LITERATURE SURVEY

Primitive blackboard erasers were initially wet cloths or wood planks attached with eraser materials. They were

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ISSN: 2278 – 909X

effective but made the user open to the chalk dust which may not be fatal but could cause allergies and problems to persons affected by asthma or any other breathing problems.

The basic architecture always included the blackboard itself as a crucial part as well as the duster placed in different manners but with a single objective to erase the blackboard.

Billie R. Crisp[2] proposed a system in 1971,an automatic duster erasing apparatus for classroom use. The movement of the shaft fixed with the eraser was primarily done by manual switches. But the most distinctive part of the mechanism was the plural dusters embedded on the shaft so as to increase the duster range as well as cleaning the blackboard became much easier. The electric motors span the whole blackboard so as to move the duster along it. The rollers at top and bottom do traverse motion.

In 1993 Solomon Forst [3] designed a blackboard erasing system. The blackboard is mounted with the cleaning apparatus fitted to the wall, it includes a separate duster apparatus rather than the cleaning material which was used in the previous models. They proposed that rather increasing the expenses on a complex mechanism as well as custom built vertical erasers we should use the normal dusters fitted on a separate block which then movers around the whole blackboard erasing it.

In 2002 Chirag Shah [4] tried to make the blackboard system with Sensors to the motors to initiate motor movement. The mechanism control switches were with the user. The duster moved to and fro to erase the blackboard. Once the motor starts moving the gear and counter gear connected to the threaded rod which then moves the shaft.

The most advanced blackboard model was designed by Jinzan Liu, Zhong Zeng & Lang Xu .This blackboard erasing system was the most advanced blackboard erasing mechanism which used cameras and digital image processing to erase the erasable markings present on the blackboard. This was a hardware and software connected system.

3. PROPOSED SYSTEM

We propose a system to interface the mechanical aspects of the mechanical erasing system with micro controllers so as to enhance it into automation rather than manual. We are using PIC micro controller to interface the board erasing mechanism.

Problem Statement

To build an automatic blackboard erasing system based on PIC microcontroller.

Objective Of The Project

To reduce the work and time required to erase the blackboard so as to ease the problems of teachers as well as students.

3.1 System Development

The main components of the system can be identified as PIC 18F458 Microcontroller, encoder and decoder(wireless transmission) and L293d motor driving IC. The initial stage includes the switches which will be used for direction of the duster with the encoder IC so as to encode the given input by the user into proper format for transmission.

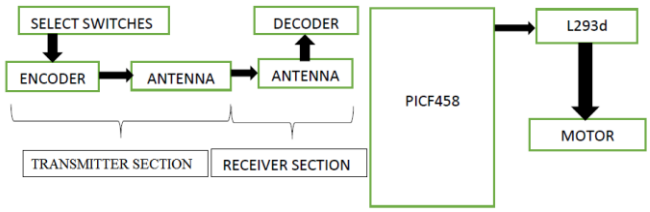


Fig 3.1 Block Diagram of Proposed System

The above block Diagram shows the detailed working structure of the proposed system.

The received signal will then be decoded by the decoder and then it will give the information to the PIC 18F458 microcontroller. PIC will then convert the data given by the user into formats as specified for the motor driver IC L293D for the movement of the motors. The input given to the L293d will then give the supply to the motor for the specific movements.

3.3 Implementation of Automatic Blackboard Eraser

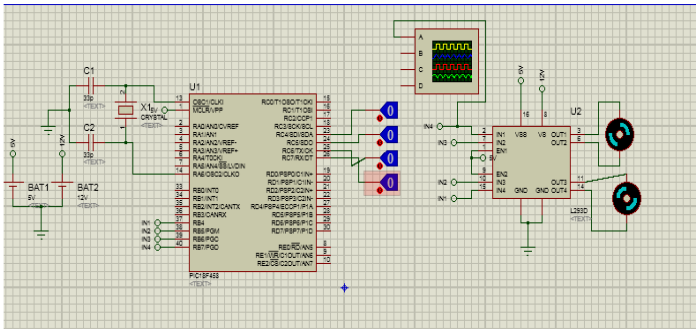


Fig 3.2 Circuit Simulation of System

The above figure shows the detailed circuit diagram of the proposed system. The microcontroller used is PIC 18F458.The output generated by encoder at the transmitter is then given to PORT C of PIC. The user when presses the switch gives the input to the encoder which encodes it into proper format. The signal is transmitted to the receiver section.

The input is then decoded using decoder. The address lines of encoder and decoder are set at 0 so as to enable the data transfer between them. The decoded bits are then given to the microcontroller which then checks it for the direction given by the user and generates proper output for the L293d to implement.

The L293d then gives the supply to the motors as specified in the output of the microcontroller and the movement starts.

3.4 Power Supply

As we require a 5V we need LM7805 Voltage Regulator IC. The current rating of the transformer depends upon the current required for the load to be driven.

The input voltage to the 7805 IC should be at least 2V greater than the required 2V output, therefore it requires an input voltage at least close to 7V.

So 6-0-6 transformer with current rating 500mA (Since $6*\sqrt{2} = 8.4V$) was selected.

ISSN: 2278 – 909X

Y=1/(4√3fRC) (as the capacitor filter is used)

f= frequency of AC (50 Hz), R=resistance calculated ,R= V/Ic

V= secondary voltage of transformer , V=6√2=8. 4

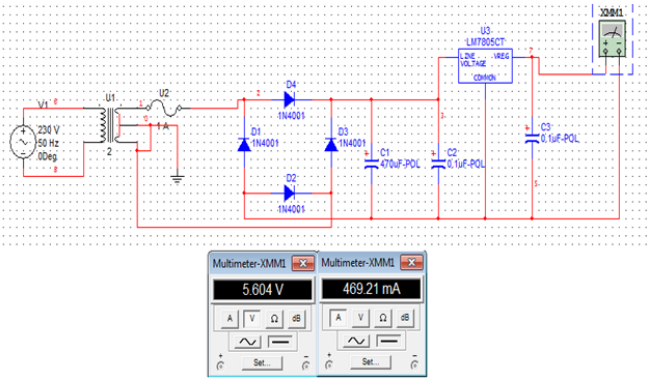
R=8.45/500mA=16.9Ω standard 18Ω chosen

C= filtering capacitance

We have to determine this capacitance for filtering

Hence the capacitor value is found out by substituting the ripple factor in Y=1/(4√3fRC)

Data sheet of 7805 prescribes to use a 0.01µF capacitor [5] at the output side to avoid transient changes in the voltages due to changes in load and a 0.33µF at the input side of regulator to avoid ripples if the filtering is far away from regulator.



4. HARDWARE SPECIFICATION

PIC 18F458

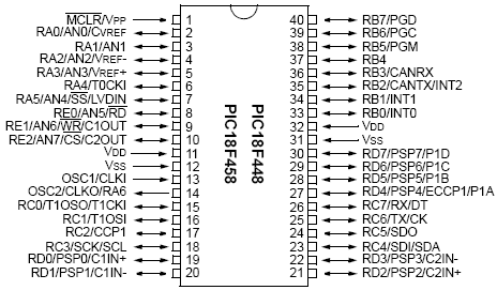


Fig 4.1 PIC 18F458

Micro controller is the heart of our circuit. It acts as an interface between Switches and motors. In this project we have use PIC18F458 microcontroller,which is a product of Microchip Corporation.[6]

L293d

It is a quadruple high current half H-drivers. They are designed to provide voltages from 4.5-36V and currents of up to 1A.They are used in our project so as to drive the 2 motors present as L293d has capacity to drive up to 2 motors at once. [7]

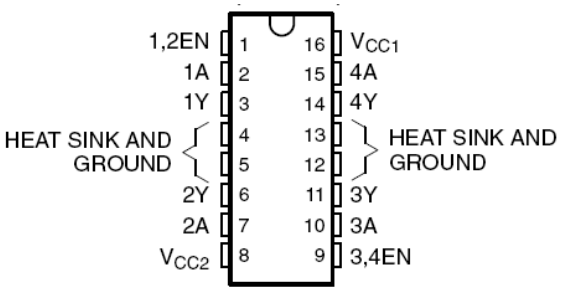


Fig 4.2 L293d

Table 4.1 Function Table

(each driver)

INPUTS†		OUTPUT
A	EN	Y
H	H	H
L	H	L
X	L	Z

H = high level, L = low level, X = irrelevant,
Z = high impedance (off)
† In the thermal shutdown mode, the output is in the high-impedance state, regardless of the input levels.

The input given to it by microcontroller decides the output to be high or low.

DC Motors

We are using DC motors here for the movement of the shaft of the duster. The DC motors are primarily devices used to convert electrical energy into physical or mechanical energy.

HT12E encoder

The 2^{12} encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12N data bits.[8]

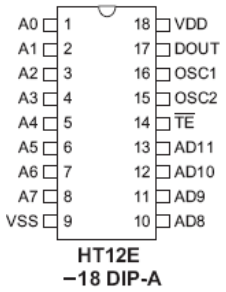


Fig 4.3 Pin Digram of HT12E encoder

. Each address/data input can be set to one of the two logic states. The programmed addresses/ data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 212 series of encoders.

HT 12D decoder

The 2^{12} decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holteks 2^{12} series of encoders (refer to the encoder/decoder cross reference table).[9]

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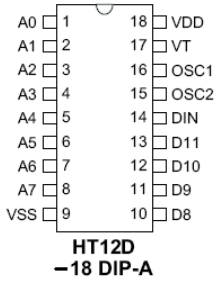

Fig 4.4 Pin Digram of HT12D decoder

For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 2^{12} series of encoders that are transmitted by a carrier using an RF or an IR transmission medium.

Push To Turn On Button

The push buttons are used here as an interface to the user for selecting the direction as to clean the half of the board.

5. SOFTWARE DETAILS

MPLAB

MPLAB is a free integrated development environment for the development of embedded applications on PIC and dsPIC microcontrollers, and is developed by Microchip Technology. It supports project management,code editing,debugging and programming of Microchip 8-bit,16-bit and 32-bit PIC microcontrollers. PIC kit programmers are also supported by MPLAB.

Eagle 6.3.0

Eagle (for: Easily Applicable Graphical Layout Editor) by Cad Soft Computer is a flexible expandable and scriptable RDA application with schematic capture editor,PCB layout editor, auto-router and CAM and BOM tools developed by Cad Soft Computer GMBH,Germany.

5. 1 Algorithm

The method used here was to move the motors placed on the top and bottom of the eraser shaft to clean the blackboard fully. When the user gives the command using the push buttons placed on the transmitter side the encoder will encode the command in a proper format so as to be transmitted. Once the data reaches the decoder and gets decoded, it gets sent to the microcontroller to identify the direction to move and appropriate output is generated so as to make L293d understand in which directions the motors need to move. Once the motor moves it again returns to the middle of the board.

5.2 Flowchart

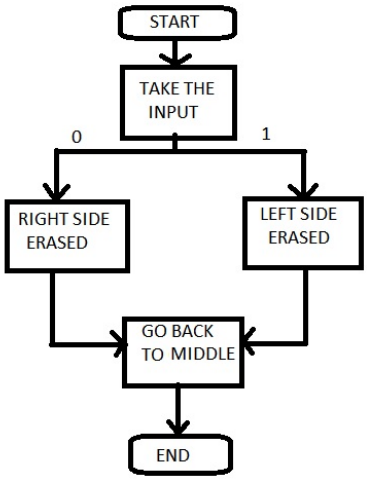

Fig 5.1 Flowchart of System

6. ACTUAL DEVELOPED SYSTEM

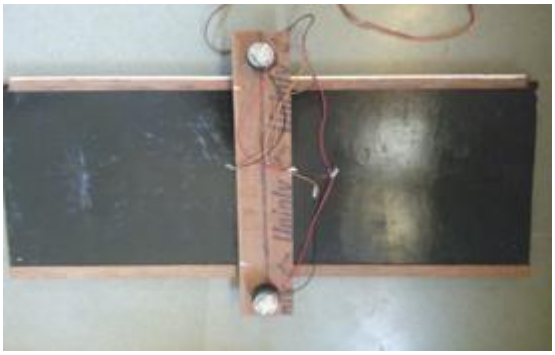

Fig 6.1 Photograph of Actual System

The frame used here was of the dimensions 75*35*2 cm. The shaft was placed in the middle of the board and has DC motors placed on its top and bottom to felicitate movement. The blackboards top and bottom have a track placed so as to define the path for the wheels to move and erase the board.

7. CONCLUSION

Automatic blackboard erasing mechanisms have been studied and implemented for erasing the blackboard automatically. It provides a better solution for the health problems, time constraints in the class rooms.We learned the basic methodology to use DC motors so as to initiate movement of shaft and microcontroller to control the movement of the shaft.

Future Scope

This Project can be further modified into a gesture controlled eraser by using camera and DSP processors so as to identify the movement of the users hand and make the duster do so.

This project can also be modified to clean glass as present on high buildings which is a very risky job for any human to perform.

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ISSN: 2278 – 909X