

BUSITEMA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING
FINAL YEAR PROJECT REPORT

TOPIC:

**DESIGN AND IMPLEMENTATION OF AN AUTOMATIC WHITEBOARD
ERASER**

BY

KIWOOMA HARUNA

BU/UG/2014/141

Email: har.mullah@gmail.com

SUPERVISOR: Ms. ASINGWIRE BARBARA KABWIGA

**A final year project report submitted to the Department of Computer Engineering at
Busitema University in partial fulfillment of the requirements for the award of the Degree
of Bachelor of Computer Engineering of Busitema University.**

May 2018

DECLARATION

I KIWOOMA HARUNA, BU/UG/2014/141 hereby declare that this project proposal is my original work except where explicit citation has been made and it has not been presented to any Institution of Higher learning for any academic award.

Signature

KIWOOMA HARUNA

BU/UG/2014/141

Date:

APPROVAL

I certify that the project proposal entitled “design and implementation of an automatic whiteboard eraser” has been done under my supervision and is submitted to the board of examiners with my approval.

Ms. ASINGWIRE BARBARA KABWIGA

Department of Computer Engineering

Sign:

Date:

DEDICATION

I dedicate this project report to my beloved parents Mr. Yusuf Ssemwanga and Mrs. Sofia Namuga for the love and support they have provided to me throughout this project period, my family and friends for the advice and financial support they rendered to me during the research period.

I also dedicate it to my project supervisor Ms. Asingwire Barbara Kabwiga for her tremendous effort and guidance in relation to my project report, the courage, and the moral & support she offered to me during my research period MAY the almighty ALLAH BLESS him.

ACKNOWLEDGEMENT

Firstly, I am very grateful to Allah who gave me a life and continue my studies until the last part of my degree.

Secondly, I would like to give all my appreciation to my father and my mother for support, guidance and encouragement to continue my study to degree level and to finish my final year project report.

I also want to really thank my beloved supervisor, Ms. Asingwire Barbara Kabwiga because she is really caring and guiding person. She always give me suggestion and guidance until I come out with this report.

Lastly, thanks to everyone that I did not mention here that involve directly or indirectly in my final year project. May Allah bless you all. Thanks.

ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
AM	Amplitude Modulation
DC	Direct Current
DMM	Digital MultiMate
IC	Integrated Circuit
IDE	Integrated Development Environment
IWB	Interactive Whiteboard
LED	Light Emitting Diode
MIT	Massachusetts Institute of Technology
PCB	Perforated Circuit Board
PM	Permanent Magnet
PWM	Pulse Width Modulation
USB	Universal Serial Bus

ABSTRACT

Whiteboards form the basis for effective learning in organizations and the educational sector.

The most common technique of erasing a whiteboard marks is by the use of a whiteboard duster which is a hand held object manually controlled by the student or teacher. Although the type of material used in wiping the board has evolved, the manual labor is still a constant factor.

Technologically, improvements have been achieved in this area where we have the Interactive Whiteboards. However, the cost of acquisition and installation is high for most institutions. The need to save time, funds and effort in schools, offices and various areas where whiteboards are applied is exceedingly growing. Through the use of an automated whiteboard eraser, this can be wholly achieved.

This report describes the design and construction of a white board eraser that completely wipes clean the board after being used with the aid of push buttons. The whiteboard eraser is a purely automated whiteboard erasing system, which incorporates a logic gate based control circuit with Arduino Atmega 328 microcontroller and a mechanical system that allows adoptability to similar sized whiteboard and is reasonably affordable. The system is designed to increase the productivity in teacher's delivery during classroom seasons, by reducing health risks, saving energy and time for the instructor.

LIST OF FIGURES

Figure 2.1: Rack and Pinion[3]	6
Figure 2.2: Sprocket.....	7
Figure 2.3: Chain	7
Figure 4.4: Guide Flow Chart Symbols	21
Figure 4.5: System Flow Chart	22
Figure 4.6: Block diagram of the system	23
Figure 4.7: Block Diagram ULN2003A, ULQ2003A and ULN2003AI	25
Figure 4.8: Pin lay out for ULN2003A	25
Figure 4.9: Diagram of LCD[32]	26
Figure 4.10: Connecting wires	26
Figure 11: Schematic Diagram	27
Figure 12: Design Code enviroment	30
Figure Appendix 13: Designed System	44
Figure Appendix 14: Rack and Pion for Duster holder.....	44
Figure Appendix 15: System Back End.....	45
Figure Appendix 16: Amphoteric Sprinkler	45

LIST OF TABLES

Table 2.1: Summary table for existing systems	14
Table 5.2: Time consumed in using Whiteboard Eraser.....	31
Table 5.3: Time consumed in using cloth.....	32
Table 5.4: Time consumed in using 3M Erasing Pad	33
Table 5.5: Time consumed and number of rounds using 3M Erasing Pad.....	34
Table Appendix 6: Time Frame	42
Table Appendix 7: Budget.....	43

TABLE OF CONTENTS

DECLARATION	i
APPROVAL	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
ACRONYMS AND ABBREVIATIONS	v
ABSTRACT.....	vi
LIST OF FIGURES	vii
LIST OF TABLES.....	viii
TABLE OF CONTENTS.....	ix
CHAPTER ONE: INTRODUCTION	1
1.0 INTRODUCTION	1
1.1 BACKGROUND	1
1.2 PROBLEM STATEMENT	2
1.3 PROJECT OBJECTIVES	2
1.3.1 MAIN OBJECTIVE.....	2
1.3.2 SPECIFIC OBJECTIVES	2
1.4 JUSTIFICATION	2
1.5 SCOPE.....	2
CHAPTER TWO: LITERATURE REVIEW	4
2.1 INTRODUCTION	4
2.2 CONCEPTS, DESCRIPTION AND DEFINITIONS.....	4
2.2.1 WHITEBOARD SURFACE.....	4
2.2.2 RACK AND PINION.....	6
2.2.3 SPROCKET	6
2.2.4 CHAIN.....	7

2.2.5 GEARS	8
2.2.6 DC MOTOR:	9
2.2.7 MOTOR DRIVER: (L293D IC)	9
2.2.8 STEPPER MOTORS.	9
2.2.9 ARDUINO UNO	10
2.3 RELATED SYSTEMS	10
2.3.1 THE AUTOMATIC BOARD ERASURE SYSTEM	10
2.3.2 A REVIEW OF AUTOMATIC BLACKBOARD CLEANING SYSTEM.....	11
2.3.3 DEVELOPMENT OF NEW SMART DESIGN TO ERASE THE CLASSROOM BLACKBOARD OF SCHOOLS/COLLEGES	11
2.3.4 AUTOMATIC CHALK BOARD CLEANER AND ENERGY HARVESTING FOR SMART CLASS ROOMS.....	12
2.3.5 A REMOTE CONTROLLED MOTORIZED WHITEBOARD CLEANER.....	12
2.3.6 MOBILE ROBOT CLEANER	12
2.4 SUMMARY FOR EXISTING SYSTEMS.....	14
2.5 THE DESIGNED SYSTEM.....	15
CHAPTER THREE: METHODOLOGY	16
3.0 INTRODUCTION	16
3.1 REQUIREMENTS GATHERING	16
3.1.1 LITERATURE REVIEW	16
3.1.2 CONSULTATIONS	16
3.2 REQUIREMENTS ANALYSIS	17
3.3 SYSTEM DESIGN	17
3.4 TOOLS FOR THE SYSTEM	17
3.4.1 HARDWARE	17
3.4.2 SOFTWARE.....	17
3.5 SYSTEM IMPLEMENTATION.....	18
3.6 TESTING AND VALIDATION	18
3.6.1 UNIT TESTING	18

3.6.2 INTEGRATION TESTING.....	18
3.6.3 SYSTEM TESTING	18
CHAPTER FOUR: SYSTEM ANALYSIS AND DESIGN	19
4.0 INTRODUCTION	19
4.1 REQUIREMENTS ANALYSIS	19
4.2 FUNCTIONAL ANALYSIS	19
4.2.1 FUNCTIONAL REQUIREMENTS	19
4.2.2 NON-FUNCTIONAL REQUIREMENTS	19
4.3 SYSTEM DESIGN	20
4.3.1 LOGICAL DESIGN OF THE SYSTEM.....	20
4.3.2 THE PHYSICAL DESIGN.....	23
4.3.3 SCHEMATIC DIAGRAM	27
CHAPTER FIVE: IMPLEMENTATION AND TESTING	28
5.0 INTRODUCTION	28
5.1 DEVELOPMENT PLATFORMS.....	28
5.1.1 ARDUINO.....	28
5.1.2 PROTEUS.....	29
5.2 CODE DESIGN	30
5.3 SYSTEM TESTING AND EVALUATION.....	30
5.3.1 MOVEMENT OF THE DC MOTORS	31
5.3.2 MANUAL AND AUTOMATIC ERASING	31
5.3.2.1 MANUAL ERASING.....	31
5.3.2.1 AUTOMATIC ERASING	34
5.3.3 DETERMINING THE APPROPRIATE SIZE OF THE WHITEBOARD	36
CHAPTER SIX: DISCUSSION AND RECOMMENDATIONS	37
6.0 INTRODUCTION	37
6.1 SUMMARY OF WORK DONE.....	37
6.2 RECOMMENDATIONS.....	38
6.3 Conclusion	38

REFERENCES	39
APPENDICES	42
DESIGNED SYSTEM APPENDIX	44
CODE APPENDIX	46

CHAPTER ONE: INTRODUCTION

1.0 INTRODUCTION

1.1 BACKGROUND

Education is a methodology which comprises of teaching and learning. In Uganda, teacher student system donates where different resources and materials are used.

In the past, man used cave walls, animal skin and slate wood board as the writing medium to capture various memories or the story of their own culture and daily activities. As civilization came, the middle age people began to use a big slice of the wood piece as the board, and coal as the pen medium. But it was not so comfortable and it became horrible since one needed to acquire new material to write instead of erasing.[1]

Later advancement brought blackboards which is nothing but a black canvas where a chalk is used as the pen medium. Chalk is a stick like composite of calcium carbonate[2]. It was comfortable but it created dust during wiping the board using the duster. Chalk dust causes serious health problems[2]. Later a whiteboard was introduced as a modified version of the blackboard to resolve the problems and widely implemented into many other sectors of human endeavor besides teaching[3]. Here a marker pen[4] is used as pen medium and as duster a piece of cloth or a foam duster. Many teachers believe they found a better way with whiteboards[5], no more chalk dust filling classroom air, no more chalk residue on your fingers, no more clapping the erasers outside after school[6].

However, there is a mysterious loss of duster due to theft in institutions and schools and a times the instructors forget and uses a permanent marker on whiteboard, or leaves the board untidy after the lecture session. The effect of permanent marker on human health is also a problem since it affects someone who has allergic reaction[5], possible ink poisoning and side effects from inhaling ink fumes[7]. Therefore, the tedious and time consuming manually cleaning mechanism together with associate problems calls for a design and implementation of an automatic whiteboard eraser.

REFERENCES

- [1] E. G. G. Diamante, K. H. Flores, E. J. A. Garcia, and L. N. Raralio, “Automatic Whiteboard Eraser Interfaced Using Assembly Language by,” no. October, 2009.
- [2] B. M. Ford, “Characterization of Climbing Chalk.”
- [3] S. Akhter, A. Saha, R. P. Koushik, I. Shorna, and M. Ahmed, “Paper ID : IE-52 Automatic Whiteboard Cleaner Using Microcontroller Based Rack and Pinion Mechanism,” vol. 2015, pp. 11–13, 2015.
- [4] P. M. Co, “Catalog,” 1970.
- [5] Jyotsna Ramani, “Advantages and Disadvantages of a Whiteboard,” June 28, 2011, 2011. [Online]. Available: <http://ezinearticles.com/?Advantages-and-Disadvantages-of-a-Whiteboard&id=6386214>. [Accessed: 13-Nov-2017].
- [6] L. A. T. Echnology, “A R EVIEW P APER ON A DVANCE B OARD C LEANER USING,” vol. 3, no. 3, pp. 139–143.
- [7] C. Are, N. Just, L. Adults, S. Are, N. Just, and L. Offices, “Children Are Not Just Little Adults,” pp. 1–3, 2011.
- [8] “What is whiteboard? - Definition from WhatIs.com.” [Online]. Available: <http://searchnetworking.techtarget.com/definition/whiteboard>. [Accessed: 09-Nov-2017].
- [9] O. E. Simolowo and O. C. Ngana, “Preliminary Design of an Automated White Board Cleaner,” vol. 8, no. 33, pp. 68–82, 2014.
- [10] “Disadvantages of Interactive Whiteboards | ezTalks.” [Online]. Available: <https://www.eztalks.com/whiteboard/disadvantages-of-interactive-whiteboards.html>. [Accessed: 13-Nov-2017].
- [11] P. O. Odiase and G. C. Okoli, “Electro-Mechanical Based Automated Whiteboard Wiper,” vol. 1, no. 1, pp. 90–94, 2016.
- [12] G. Gangurde, “Design and Development of Board Cleaning System,” vol. III, no. Iii, pp. 38–41, 2016.

- [13] I. Engineering, ““ Design and Fabrication of Automatic Blackboard Duster ,”” vol. I, no. 2, 2015.
- [14] R. M. S. . Rathnayaka, R. Ariyaratne. A, and S. . Prematilake, “Design and Fabrication of an,” Trop. Agric., vol. 18, no. December 2001, pp. 525–528, 2015.
- [15] S. Process, Chapter 1 — Introduction Chapter 2 — Search Techniques Chapter 3 — Knowledge-Based Expert System Chapter 4 — Engineering Design Synthesis Chapter 5 — Criticism and Evaluation. .
- [16] M. Control, “Stepper motor.”
- [17] S. Motors, “Introduction to Stepper Motors Topics discussed in this WebSeminar : – Main components of a stepper motor,” pp. 1–49, 2007.
- [18] E. Access and W. Andrews, N o S t a r c h p r e s s e a r l y a c c e s s p r o g r a m : Feedback welcome ! .
- [19] “Programming Arduino Getting Started with Sketches by Simon Monk.” .
- [20] A. H. M. F. Elahi, “Development of an Automatic Board Cleaning system using Microcontroller,” 2014.
- [21] S. R. Kewate, I. T. Mujawar, A. D. Kewate, and H. R. Pant, “Development of New Smart Design to Erase the Classroom Blackboard of Schools / Colleges,” vol. 2014, pp. 57–61, 2014.
- [22] T. Jacob, “A Review of Automatic Blackboard Cleaning System,” vol. 4, no. 2, pp. 208–211, 2016.
- [23] C. Sharmila, M. Ramya, and S. Sarnya, “Automatic Chalk Board Cleaner and Energy Harvesting for Smart Class Rooms,” vol. 5, no. 1, pp. 399–401, 2016.
- [24] T. Jacob, “A Remote Controlled Motorized White Board Cleaner,” vol. 15, no. 4, pp. 273–280, 2012.
- [25] T. C. S. Programmes, The mechatronics, no. February. 2002.
- [26] O. Access, S. O. F. Supervisor, and N. O. F. Supervisor, “i UNIVERSITI TEKNOLOGI MALAYSIA ii “ I declare that I have read this final year project report

and in my opinion , this final year project report is sufficient in terms of scope and quality for the purpose to be awarded the Degree of Bachelor Engineering ,” vol. 16, no. June, 2015.

- [27] Ai robotics. .
- [28] T. Ulna, “ULN2002A / ULN2003A / ULN2004A ULN2004A Pin Descriptions,” no. January, pp. 1–13, 2017.
- [29] O. C. Diodes, R. Applications, R. Drivers, L. Drivers, L. Drivers, and L. Buffers, “ULN200x , ULQ200x High-Voltage , High-Current Darlington Transistor Arrays,” 2016.
- [30] S. D. Arrays, “Uln2001a-uln2002a uln2003a-uln2004a,” no. February, pp. 1–8, 2002.
- [31] H. Max, “Vishay 16 x 2 Character LCD ITEM SYMBOL STANDARD VALUE UNIT ITEM SYMBOL CONDITION FUNCTION,” pp. 31–33.
- [32] F. Specs, “► Introduction ► Pin Description.”