



FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING AND INFORMATICS

FINAL YEAR PROJECT REPORT

**AN OVERTAKING VEHICLE ACCIDENT PREVENTION
AND ALERT SYSTEM**

BY

EBOLIAS JESSE

REGISTRATION NUMBER: BU/UP/2020/1246

Email: eboliasjesse@gmail.com

SUPERVISOR: Mr. ARINEITWE JOSHUA

A final year project report submitted to the department of computer engineering and informatics at Busitema university in fulfillment of the requirements of the award of the degree of bachelor of science in computer engineering of Busitema university.

June, 2024

DECLARATION

I **EBOLIAS JESSE** hereby declare that the project report is my original work and has never been submitted to any other institution of higher learning or university.

Name..... EBOLIAS JESSE.....

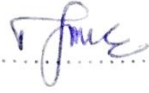
date..... 25/06/2024.....

Sign..... [Signature].....

APPROVAL

This is to certify that the project titled “AN OVERTAKING VEHICLE ACCIDENT PREVENTION AND ALERT SYSTEM” has been done under my supervision and is ready for submission.

Signature.....



Date.....



Mr. Arineitwe Joshua

DEPARTMENT OF COMPUTER ENGINEERING AND INFORMATICS

ACKNOWLEDGEMENT

First and foremost, I would to thank the Almighty God for the successful completion of the project proposal report.

I would also like to appreciate my parents for supporting me in all circumstances and what I would like to achieve.

I would also like to thank my academic supervisor Mr. Arineitwe Joshua at the FACULTY OF ENGINEERING AND TECHNOLOGY OF BUSITEMA UNIVERSITY in the DEPARTMENT OF COMPUTER ENGINEERING AND INFORMATICS.

Finally, I would like to thank Lecturers at the DEPARTMENT OF COMPUTER ENGINEERING AND INFORMATICS Dr. Alunyu Andrew Egwar, Prof. Ocen Gilbert, Dr. Matovu Davis, Madam. Nalwanga Rosemary, Mr. Arineitwe Joshua for the consultations and guidance.

ABSTRACT

In the country and the world, accidents take lives of over 1.25 million people and 50 million with injuries and loss of property that has an impact on the livelihood of the people who are caught in the midst of the accidents.

One of the causes of accidents is careless overtaking and driving carried out by most drivers on the roads that lead to increase in the deaths, injuries and property losses that have a great impact on the economic growth and development of a country.

The development of an overtaking vehicle accident prevention and alert system enables to ensure that drivers can Exercise caution, accuracy and patience when making complex overtaking maneuvers in two-way roads.

Methodology, this involved the requirement gathering, analysis, the design and development, testing and validations executed to achieve the main objective of the project. It also comprises of the results data the system

Discussion and Recommendations, describes the summary of the work executed to come up with the system, system limitations, challenges faced and conclusion.

TABLE OF FIGURES

Figure 1:3.3.1	15
Figure 2:3.3.2	16
Figure 3:3.3.3	16
Figure 4:3.3.4	17
Figure 5:3.3.5	18
Figure 6:4.3.1	20
Figure 7:4.3.3	22
Figure 8:4.3.4	23
Figure 9:4.3.5	23
Figure 10:5.4	26
Figure 11:5.4	26
Figure 12:5.4	26
Figure 13:5.4	27
Figure 14:5.4	27
Figure 15:5.4	28
Figure 16:5.4	28
Figure 17:5.4	29

LIST OF TABLES

Table 1: existing systems:2.10	12
Table 2:5.4	26
Table 3:5.4	29

TABLE OF CONTENTS

DECLARATION	i
APPROVAL	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
LIST OF ACRONYMS	x
CHAPTER ONE: INTRODUCTION	1
1.1 Introduction	1
1.2 Motivation	2
1.3 Problem statement.....	3
1.4 Objectives.....	3
1.4.1 Main objective	3
1.4.2 Specific objectives	3
1.5 Justification	3
1.6 Scope of study	4
1.6.1 Technical scope	4
1.6.2 Geographical scope.....	4
1.6.3 Time scope.....	4
CHAPTER TWO: LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Key terms	5
2.2.1 Mirror, Signal, Maneuver (MSM)	5
2.2.2 Risk.....	5
2.2.3 Overtaking	5
2.2.4 Head-On Collision.....	6
2.2.5 Fender-Bender	6
2.2.6 Pile-Up.....	6
2.2.7 Hit and Run.....	6
2.2.8 Slam on the Brakes	6
2.2.9 Rear-End Collisions.....	6
2.2.10 Lost Control While Overtaking	6
2.3 Unsafe Overtaking Situations	6
2.3.1 Double White Line Rule.....	6

2.3.2 No Overtaking Sign	7
2.4 Types of Overtaking Maneuvers	7
2.4.1 Accelerating overtaking.....	7
2.4.2 Flying overtaking.....	7
2.5 Avoid overtaking when it's not safe	7
2.6 Be aware of the surroundings.....	8
2.7 Use of signals	8
2.8 Do not overtake on the left.....	8
2.9 Do not tailgate	8
2. 10 Existing systems.....	8
2. 10.1 Accident prevention system and accident detection systems	8
2. 10.2 Behavioral-Based Interventions	9
2. 10.3 Designing System Reforms	9
2. 10.4 Line-following robot.....	10
2. 10.5 Obstacle avoiding robot.....	10
2. 10.6 Traditional technique Or Mirror, Signal, Maneuver (MSM).....	11
2. 11 Summary of existing systems.....	12
2.11 Developed system	13
CHAPTER THREE: METHODOLOGY	14
3.1 Introduction	14
3.2 Requirement gathering and Data Collection	14
3.3 Requirement analysis	15
3.3.1 Arduino.....	15
3.3.2 Ultrasonic sensor	16
3.3.3 DFPlayer mini Mp3 module	16
3.3.4 Loud speaker.....	17
3.3.5 Accelerometer.....	18
CHAPTER FOUR: SYSTEM ANALYSIS AND DESIGN.....	19
4.1 Introduction	19
4.2 Requirement analysis	19
4.2.1 Functional requirements	19
4.2.2 Non-functional requirements	20
4.3 System design.....	20
4.3.1 System block diagram	20

4.3.2 MATHEMATICAL MODEL/ DESGIN.....	21
4.3.3 Flowchart.....	22
4.3.4 CIRCUIT DIAGRAM.....	23
4.3.5 PHYSICAL DESIGN.....	23
CHAPTER FIVE: IMPLEMENTATION AND TESTING	24
5.1 Introduction.....	24
5.2 Development platforms.....	24
5.2.1 Arduino (IDE).....	24
5.2.2 Fritizing.....	24
5.2.3 Draw.io.....	24
5.2.4 Code design.....	24
5.3 Testing.....	24
5.3.1 Unit testing.....	25
5.3.2 Integration testing.....	25
5.3.3 System testing.....	25
5.3.4 System validation.....	25
5.4 Results of the system.....	25
CHAPTER SIX: DISCUSSION AND RECOMMENDATION	30
6.1Introduction.....	30
6.2 Summary of work done.....	30
6.4 Challenges faced.....	30
6.5 Recommendations.....	30
6.6 Conclusion.....	31
References.....	32
APPENDIX.....	35
Code.....	35
INTERVIEW SCHEDULE.....	42
QUESTIONNAIRE.....	44

LIST OF ACRONYMS

UN	United Nations
W.H. O	World Health Organization
UPF	Uganda police force
IDE	Integrated Development Environment
IEEE	Institute of Electrical and Electronic Engineers
IoV	Inspector of Vehicles
TRSA	Transport and Road Safety Act
RS	road safety
MSM	Mirror, Signal, Maneuver
RSPR	Road Safety Performance Review
TSDP	Transport Sector Development Programme
TLB	Transport Licensing Board
PSV	public service vehicle

CHAPTER ONE: INTRODUCTION

1.1 Introduction

According to the Uganda Road Safety Performance Review Report states that over 1.25 million people die and up to 50 million are wounded on the world's roads each year. The United Nations General Assembly declared 2010 to be a Decade of Action for Road Safety (2011–2020). The Decade aims to stabilize and subsequently lower the projected number of road deaths globally. In 2015, the Decade's mid-term review was completed, and the number of yearly road traffic deaths worldwide had changed very little. The United Nations Secretary-General designated his first-ever Special Envoy for Road Safety in 2015 in this very context. With the inclusion of road safety in the Sustainable Development Goals-target 11.2: ensuring that everyone has access to safe, affordable, accessible, and sustainable transportation systems by 2030 and the goal of halving the number of traffic-related injuries and deaths by 2020, significant progress has been made on a worldwide scale [1] [2] [3].

Information on road safety from 175 countries is presented in the World Health Organization's (WHO) 2018 Global Status Report on Road Safety (WHO, 2018b). This report, the fourth in a series, gives a general overview of the state of road safety around the world.

The official instrument for tracking the Decade of Action is the worldwide status reports. According to the World Health Organization (WHO), up to 50 million people are wounded and 1.35 million people lose their lives on the world's roads each year (Association for Safe International Road Travel, no date) [2] [4].

Moving people, animals, and products from one place to another is known as transportation. Transportation forms a vital part of the infrastructure for economic and social development of a country [3].

A road traffic accident is any incident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person [4] [5].

432 traffic accidents were reported in a recent report, 97 of which were fatal, 202 of which were serious, and 133 of which were minor, according to the Ugandan police force. Three hundred and twenty-four persons were injured, and one hundred died [6].

Forty pedestrians and forty motorbike riders-13 passengers and 29 riders-were among the dead.

References

- [1] Jean Todt United Nations Secretary-General's Special Envoy for Road Safety, "Road Safety Performance Review," February 2018. [Online]. Available: https://unece.org/DAM/road_Safety/Documents/RSPR_Uganda_February_2018/Uganda_Road_Safety_Performance_Review_Report_web_version.pdf. [Accessed 26 feb 2024].
- [2] ". "Uganda National Road Authority, " PreventionWeb," 21 Sep 2021.. [Online]. Available: <https://www.preventionweb.net/organization/uganda-national-road-authority>. [Accessed 26 feb 2024].
- [3] "Performance reports," Ministry of Works and Transport., [Online]. Available: <https://www.works.go.ug/policies-regulations/sector-performance-reports>. [Accessed 26 feb 2024].
- [4] ""Road traffic accident,"," UNDRR, 07 Jun 2023. [Online]. Available: <https://www.undrr.org/understanding-disaster-risk/terminology/hips/tl0052?quickUrl=true>. [Accessed 26 feb 2024].
- [5] M. Nankinga, "Inspectorates of vehicles undergo refresher course," Uganda Police Force, 07 Nov 2018. [Online]. Available: <https://www.upf.go.ug/inspectorates-of-vehicles-iovs-undergo-refresher-course/>. [Accessed 26 feb 2024].
- [6] B. M. Bashir, "TRAFFIC ACCIDENT REPORT," Uganda Police Force, 17 Jul 2023. . [Online]. Available: <https://www.upf.go.ug/traffic-accident-report/>. [Accessed 26 feb 2024].
- [7] "Traffic and Road Safety Act, 1998 (Amendment) (No. 2) Act, 2023 - Uganda Revenue Authority," Uganda Revenue Authority, 01 Aug 2023.. [Online]. Available: <https://ura.go.ug/en/download/traffic-and-road-safety-act-1998-amendment-no-2-act-2023/>. [Accessed 26 feb 2024].

- [8] E. R. Sahani, "Overtaking Sight distance- derivation and numerical example," Civil Concept, 18 May 2020. [Online]. Available: https://www.civilconcept.com/overtaking-sight-distance/?expand_article=1. [Accessed 26 feb 2024].
- [9] W. contributors, "Collision avoidance system," Wikipedia, 25 Feb 2024. [Online]. Available: https://en.wikipedia.org/wiki/Collision_avoidance_system. [Accessed 26 feb 2024].
- [10] A. Leanse, "What is automatic emergency braking? Top questions about the safety tech answered," MotorTrend, 16 Jun 2020. [Online]. Available: <https://www.motortrend.com/features/automatic-emergency-braking/>. [Accessed 26 Feb 2024].
- [11] C. D. Schools, "How to check your mirrors while driving (With Ease)," Champions Driving School, 08 Oct 2023. [Online]. Available: <https://championsdrivingschools.com/how-to-check-car-mirrors/>. [Accessed 26 feb 2024].
- [12] W. contributors, "Overtaking," Wikipedia, 05 Oct 2023. [Online]. Available: <https://en.wikipedia.org/wiki/Overtaking>. [Accessed 26 feb 2024].
- [13] B. Kraft, "Types of car accidents," Kraft & Associates, Attorneys at Law, P.C., 27 Jul 2023.. [Online]. Available: B. Kraft, "Types of car accidents," Kraft & Associates, Attorneys at Law, P.C., <https://www.kraftlaw.com/car-accidents/types-of-car-accidents/>. [Accessed 26 feb 2024].
- [14] "Overtaking - ROSPA," [Online]. Available: <https://www.rospa.com/policy/road-safety/advice/drivers/overtaking>. [Accessed 26 feb 2024].
- [15] electronicsworkshop111, "ACCIDENT PREVENTION, DETECTION AND REPORTING SYSTEM USING ARDUINO," AUTODESK Instructables, [Online]. Available: <https://www.instructables.com/ACCIDENT-PREVENTION-DETECTION-AND-REPORTING-SYSTEM/>. [Accessed 26 feb 2024].

- [16] R. M. M. S. M. e. a. Fisa, "Effects of interventions for preventing road traffic crashes: an overview of systematic reviews,," *BMC Public Health* 22, no. <https://doi.org/10.1186/s12889-021-12253-y>, 2022.
- [17] R. G. v. M. M. C. A. a. S. P. Goode N, "Designing System Reforms: Using a Systems Approach to Translate Incident Analyses into Prevention Strategies," *frontiers*, vol. Volume 7, no. Front. Psychol. 7:1974. doi: 10.3389/fpsyg.2016.01974, 2016.
- [18] Mati_DIY, "Line Follower Robot With Arduino - Very Fast and Very Simple," AUTODESK Instructables, [Online]. Available: <https://www.instructables.com/Line-Follower-Robot-With-Arduino-Really-Fast-and-R/>. [Accessed 26 feb 2024].
- [19] N. KGD, "Obstacle Avoiding Robot (Arduino)," AUTODESK Instructables, [Online]. Available: <https://www.instructables.com/Obstacle-Avoiding-Robot-Arduino-1/>. [Accessed 26 feb 2024].