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# FINAL YEAR PROJECT REPORT

## BODA-BODA RIDER SAFETY AND ACCIDENT AVOIDANCE SYSTEM

by

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

**December 2020**

## Abstract

The increased adoption of the boda-bodas in Uganda has created employment opportunities to many people in Uganda especially the youth, thus enabling them meet their standards of living. But this has exponentially contributed to bigger statistics of road accidents in Uganda. This has led to mainly fatality and trauma. The accidents are mainly caused by not wearing helmets, drinking alcoholic substances before operating a motorcycles careless riding.

This research is focused on reducing on the fatality rate, trauma and other effects that arise from boda-boda accidents and also ensure that boda-boda riders avoid them. This happens through using technology by developing an intelligent system to ensure that riders always wear their helmets.

The system achieves its objective through the use of sensors (alcohol sensor, infrared sensor) inside the helmet, GSM and GPS to ensure that boda-boda riders wear helmets at all times before operating a motorcycle and also to alert paramedic or relative in case an accident occurs.

## Declaration

I **GABULA PIUS** hereby declare this project proposal my original work with exceptions of where citations have been made and this paper has not been presented to any higher institution of learning for the award of academic paper.

Signature _____

Date 27/01/2021.

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## Approval

This is to certify that the project proposal entitled "BODA-BODA RIDER SAFETY AND ACCIDENT AVOIDANCE SYSTEM" has been under my supervision and has been submitted to the board of examiners with my approval

Signature: _____

Date: 27/01/2021

**Mr. Bwire Felix**

Department of Computer Engineering.

## List of Acronyms

| | |
|---|---|
| **GSM** | Global System for Mobile Communication |
| **GPS** | Global positioning System |
| **PIR** | Passive Infrared |
| **IR** | Infrared |
| **RF** | Radio Frequency |
| **ICCU** | Injury Control Centre Uganda |
| **IDE** | Integrated Developers Environment |
| **LCD** | Liquid Crystal Display |
| **BAC** | Blood Alcohol Level |

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# Chapter 1: Introduction

This chapter includes the background, problem statement, objective and specific objectives, significance of study and the scope of the study.

## 1.1 Background

The growing population of African countries has led to a higher increase in demand of a reliable means of transport for carrying goods and passengers to distant places [1][2]. This has given birth to a motorcycle mode of transport in Uganda commonly known as boda-boda. The word Boda-boda is "a type of motorcycle or bicycle with a space for a passenger or for carrying goods, often used as a taxi". The term originates from the Busia district of Uganda that borders Kenya in the east some 50 years ago when innovative Ugandans provided a way by using Bicycles for bus passengers who had to disembark on one side of the border and walk a long distance to the other [3]. Since then the boda-boda taxi service which was introduced in the 1970s has upgraded from bicycles to motorcycles in major cities of Uganda like Kampala, Jinja, Mbale etc. Research shows that Nigeria is the largest importer of motor cycles from India followed by Angola with Uganda coming in at third position [4].

The increased adoption of the boda-boda has exponentially contributed to bigger statistics of road accidents in Uganda. The number of motorbike accidents has increased exponentially. According to the Injury Control Centre, there are up to 20 boda-boda related cases at Mulago National Referral hospital in Kampala every day. Road Traffic Crashes are the leading cause of trauma and two wheelers were involved in 41% of all trauma patients according to Mulago hospital [5]. The impact when a motorcyclist involves in a high-speed accident without wearing a crush helmet is very dangerous and can cause fatality.

A study conducted by the Injury Control Centre Uganda at the national referral hospital shows a decline in the use of crush helmets. In 2011, 30.5 per cent of riders used crush helmets, while 0.8 per cent of crush helmet use was recorded among passengers. A previous study done by the ICCU and the World Health Organization in 2006 registered 42.6 per cent crush helmet use by riders and 0.26 per cent among passengers [6]. Two patients die on average every week at Mulago hospital as a result of boda-boda accidents. Between 10 and 20 victims of boda-boda accidents are received at Mulago hospital on a daily basis and 20 per cent of the victims are left disabled. The 2011 annual traffic report showed that a total of 1,762 serious accidents involving motorbikes occurred in the capital city during that year. The traffic commander of

## 6.5 *Referances*


[1] "Africa Two-Wheeler Market by Vehicle Type, by Country, Competition Forecast & Opportunities, 2011 - 2021: TechSci Research Report." [Online]. Available: https://www.prnewswire.com/newsreleases/africa-two-wheeler-market-by-vehicle-type-by-country-competition-forecast--opportunities2011---2021-techsci-research-report-614256663.html. [Accessed: 29-Oct-2019].

[2] "Motorcycles set to become main mode of transport in Africa - The East African." [Online]. Available: https://www.theeastafrican.co.ke/business/Motorcycles-set-to-become-main-mode-of-transport-inAfrica/2560-3395016-kyqnel/index.html. [Accessed: 27-Oct-2019].

[3] "The Evolution Of The Motorcycle Transport System." [Online]. Available: https://www.newvision.co.ug/new_vision/news/1185829/evolution-motorcycle-transport. [Accessed: 10Nov-2019].

[4] "Motorcycles set to become main mode of transport in Africa." [Online]. Available: https://www.bizcommunity.com/Article/196/582/151424.html. [Accessed: 10-Nov-2019].

[5] "Uganda motorbike deaths: concerns grow over silent killers | Amy Fallon | Global development | The Guardian." [Online]. Available: https://www.theguardian.com/global-development/2013/aug/13/ugandamotorbike-deaths-road-safety-boda-bodas. [Accessed: 29-Oct-2019].

[6] J. Todt, "Road Safety Performance Review Uganda," 2018.

[7] R. Sebaggala, F. Matovu, D. Ayebale, V. Kisenyi, and M. Katusiimeh, "THE COST OF MOTORCYCLE ACCIDENTS IN UGANDA," 2014.

[8] "Traffic and Road Safety Act 1998 | Uganda Legal Information Institute." [Online]. Available: https://ulii.org/ug/legislation/consolidated-act/361. [Accessed: 10-Nov-2019].

[9] "Half of all recent injuries or accidents are linked to boda-bodas – PML Daily." [Online]. Available: https://www.pmldaily.com/features/2019/08/half-of-all-recent-injuries-or-accidents-are-linked-to-bodabodas.html. [Accessed: 11-Nov-2019].

[10] S. Chandran, S. Chandrasekar, and N. E. Elizabeth, "Konnect: An Internet of Things(IoT) based smart helmet for accident detection and notification," *2016 IEEE Annu. India Conf. INDICON 2016*, pp. 1–4, 2017.

[11] F. Bin Basheer, J. J. Alias, C. M. Favas, V. Navas, N. K. Farhan, and C. V. Raghu, "Design of accident detection and alert system for motor cycles," *c2013 IEEE Glob. Humanit. Technol. Conf. South Asia Satell. GHTC-SAS 2013*, pp. 85–89, 2013.

[12] "Articles - How Breathalyzers Work." [Online]. Available: http://www.breathalyzeralcoholtester.com/how-breathalyzer-works.

[13] M. Sumamah, M. Faiz, and A. Tyagi, "Smart helmet kit," pp. 3018–3020, 2018.

[14] D. Matrix, L. Crystal, and D. Controller, "Hd44780u (lcd-ii)," vol. 272, pp. 5–20.