# BUSITEMA UNIVERSITY

# FACULTY OF ENGINEERING

# DEPARTMENT OF COMPUTER ENGINEERING

## A TRAIN ACCIDENT PREVENTION SYSTEM.

BY

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# Declaration

I, MUSINGUZI SAMUEL, REG.NO.BU/UG/2012/1797, hereby declare that this Project report 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.

Sign: ……

Date: …….

# Approval

This is to certify that the Project report under the title “A Train Accident Prevention System” has been done under my Supervision, and is now ready for submission to the Department of Computer Engineering.

Mr. Arineitwe Joshua

Department of Computer Engineering

Sign: ……

Date: ……

# Dedication

I dedicate this Project report to my dear Mum, Ms.Mbabazi Joy. I am very grateful for the support. May the Almighty God richly bless you.

## Acknowledgement

Great and sincere appreciation goes to my family members especially my Mum and my Sisters for the support and encouragement.

I also extend my thanks to Mr. Arineitwe Joshua and the entire Staff of Department of Computer Engineering, Busitema University for the knowledge, guidance and support during the preparation of this report.

May God bless your efforts to shape me.

Thanks.

# Abstract

The increased need and growth in the railway sector has resulted in an increase in the train traffic density across the East Africa especially in Kenya, from Mombasa to Uganda due to increased business and travel of people. This has resulted in the increase in the number of accidents involving trains especially in town areas where several activities are taking place and lots of traffic happening. In this report, the proposed system includes features which prevent train accidents causes highlighted inside this report. It includes automatic gate controls at the road railway junctions RF based and the automatic train slowdown at detection of an obstacle ahead to avoid severe collision using ultrasonic sensing. This system makes use of ultrasonic sensors and RF transceiver among other components.



**Keywords**: Train gate control, RF, Ultrasonic sensor, automatic slowdown.

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# List of Acronyms

| | |
|---|---|
| LCD | Liquid Crystal Display |
| RF | Radio frequency |
| DC | Direct current |
| AC | Alternate Current |
| LED | Light Emitting Diode |
| ISP | In system Programmer |
| I/O | Input /Out put |
| ATC | Automated train control |
| GoA | Grades of Automation |
| STO | Semi -automated Train Operation |
| DTO | Driverless Train Operation |
| UTO | Unmanned Train Operation |
| GSM | Global system for mobile |
| TETRA | Terrestrial Trunked Radio. |
| RISC | Reduced Instruction Set Computer |
| URC | Uganda Railways Corporation |
| RVR | Rift Valley Railways |

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# CHAPTER ONE: INTRODUCTION

## 1.1Background.

On 30th October 2013, at least 11 people were killed and 34 wounded in Kenya's capital, at Mutindwa junction in Umoja, Nairobi, when a passenger train smashed into a 33-seater bus as said by Kenyan Red Cross. Nairobi police Chief Benson Kibui said the bus crossed the railway line as the train came at high speed. The Chief and other correspondents further reported that Accidents in Kenya are often caused by of lack of safety measures on roads and rail crossings [1].

On 9th July 2012, an unidentified man was killed instantly at a railway crossing in Kampala when a train crashed into three people on commuter motor bike (Bodaboda).According to the police, the cyclist Isaac Bogere of Namuwongo and the second client remained unconscious after being rushed to Mulago National Referral Hospital [2].

Reports by PANA press indicate that a Ugandan cargo train caught fire on 10 April 2002 after it hit a Rwandan- registered fuel tanker at a rail crossing in the south-east industrial area of the capital Kampala.
Six people were injured in the accident, which happened in the afternoon, and were taken to the city's Mulago Hospital. Police and the URC authorities said that the six URC workers were hospitalized with burns [3].

These are some of the few factual examples among more others not included in this report which indicate the recent rampant train accidents in East African states of Uganda and Kenya.

Train accidents in Uganda, especially in Kampala metropolitan areas, also have gradually increased due to urban expansion and growth which has come with increased number of people who have encroached and carried out activities like businesses, markets, along the railway line gazzeted areas, case in point, the traders in Kireka, a suburb of Kampala. This has on many occasions resulted into the train hitting several people. This is caused by lack of any communication, alerting or guiding mechanisms in such places. Example of red spots identified include; Mukwano, Kireka, old port bell and Mbuya cross points [4]. Therefore, there is a need for a reliable less costly real time alerting system that can both notify the train drivers of a potential collision and people affected by the railway line, of an approaching train. Most collision

or accident avoidance systems currently being mostly implemented are focused on road transport or inter vehicle communication than trains since road transport is the most commonly used means of transport across the whole world [5].This technology is mostly currently being implemented in modern brands of expensive vehicles including New model Benz Classes ,Limos, Cheroke, Jeep ,Jaguar and others. However, Automobile companies like Hyundai, specializing in this field of railway transport have started making innovations in order to improve on automation to this means of transport majorly focusing on the safety issues, Ergonomics and comfort of passengers, and speed control mechanisms. However, there is still need to use appropriate and different technologies to have a wide range of alternatives in solving the existing technological challenges.

## 1.2 Problem Statement

Train accidents, are majorly as a result of human error, trespassing, and encroachment on the train gazzeted areas. These errors have been geared by increased human activities along the railway line, like the market in Kireka among others and also lacking of any control mechanisms at railway-road cross points. The use of automated controls and measures therefore will give reliable solutions to greatly suppress the causes of these accidents in identified dangerous railway areas.

## 1.3 Objectives.

### 1.3.1 Main Objective

To design and implement a Train Accident Prevention System.

1.3.2 Specific Objectives

i. To study and review the related existing systems and identify the requirements necessary for the Train Accident Prevention System.
ii. To simulate the proposed system, study its behavior and other constraints.
iii. To design the modules that will make up the Train Accident Prevention System.
iv. To integrate the modules that will make up the Train Accident Prevention System.
v. To test and validate the Train Accident Prevention System.

## 1.4 Justification.

The implemented system prevents the train from head-on collisions with either other approaching train or any blocking obstacles. This is both a lifesaving, safe business transaction and train

safety strategy. The system also notifies the people of an approaching train and then automatically controls the gates at cross junctions to enhance safety by using RF and thisthus eliminates the burden of relying on inefficient manual labor. With this importance, in the long run, less costs and appreciable efficiency is realized in deploying this kind of system.

### 1.5. Scope.

The system focuses at enhancing safety in the Rift Valley Railways operating in East African states of Uganda and Kenya. The mechanisms embedded in it to improve on its safety include; automatic braking whenever an obstacle is detected ahead on its way, to avoid an imminent severe collision, with the help of the Ultrasonic transceiver obstacle detection, and thus, aids in achieving this kind of braking without driver's input. Also by the use of RF transceiver, the system has a primary safety function, aimed at auto closure and opening of cross points, triggering on alerts, achieved through the use of RF receiver equipment installed at critical points along the railway line, wirelessly communicating with the transmitter equipment installed on the approaching train. The system is thus limited to these two functions. Technically, however, the effectiveness of this integrated system is well achieved in slow or average speed trains so far used in these two states. For good performance, the system is also limited to straight or relatively straight parts of the railway excluding sharp curves since Ultrasonic sensor waves do not bend around the corner.

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