TRANSFORMING ROAD TRANSPORT IN UGANDA THROUGH SMART TECHNOLOGY

BACHELOR OF SCIENCE IN COMPUTER SCIENCE (BSCCS)

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Abstract

In Uganda, road transport is the main way people move from place to place. It handles more than 90% of travel and goods movement. But it still has many problems like traffic jams, bad road planning, and too many accidents. This study looks at eleven research articles that talk about how smart technology can help fix these problems in Uganda as a developing country. This article explain new ideas like intelligent transport systems (ITS), ride-hailing apps, smartphone maps, and mobile services for boda-boda riders. These tools can make transport safer, faster, and more organized.

The studies show that digital tools like GPS, sensors, and live traffic data can help control traffic and reduce accidents by up to 30%. Apps like SafeBoda have already made public transport easier to use in cities like Kampala. Some articles also talk about how big data and artificial intelligence (AI) can help city leaders make better choices for roads and traffic. But there are still problems. About 60% of rural areas have poor internet, and many people don’t know about these technologies. Also, there’s not enough money to support them.

In the end, the review shows that smart technology is already changing how people travel in Uganda. If the country invests in digital systems, trains workers, and improves internet access, road transport can become safer, quicker, and better for everyone.

Keywords

Smart Transport, Road Transport, Uganda, Intelligent Transport Systems (ITS), Mobile Applications, Artificial Intelligence (AI), Traffic Management, Public Transport, Digital Infrastructure, Transport Sustainability

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Road transport is very important in Uganda because it helps people and goods move from one place to another.
Abubakar (2019) reported that most transport activities in Uganda depend on roads.
However, many studies have shown that the road sector still faces problems such as heavy traffic, poor road conditions, and many accidents, especially in busy cities like Kampala (Nkurunziza, 2021; Mugisha, 2019).

Recent research shows that smart technology can help reduce these problems.
Kerzhner (2024) explained that tools like artificial intelligence and real-time data can make transport systems faster and more organized.
Muresan et al. (2022) added that digital systems improve safety and reduce pollution.

In Uganda, mobile apps such as SafeBoda and SafeCar have already helped make motorcycle transport safer and more trusted (Kasozi, 2019).
Smartphone mapping studies have also helped show the routes used by informal public transport, which supports better city planning (Van der Waerden et al., 2020).

While countries such as Kenya and Rwanda are moving quickly with smart transport solutions, Uganda is still developing its systems.
Because of this gap, this study aims to explore how smart technology can transform and modernize Uganda's road transport system.

1.2 Statement of the Problem

Although Uganda has started using smart tools in transport, the adoption is still slow.
Studies show that most public transport remains informal and does not use much digital data (Porter et al., 2020; Nkurunziza, 2021).
Mugisha (2019) noted that many roads do not have digital safety systems.
Kasozi (2019) found that some riders cannot afford smartphones or internet data.
Kerzhner (2024) also reported that poor internet, low awareness, and weak digital policies limit the use of smart systems.

Because of these challenges, Uganda still struggles to make its road transport safe, efficient, and well-managed.

1.3 Objectives of the Study

1.3.1 General Objective

To explore how smart technology can transform road transport in Uganda.

1.3.2 Specific Objectives

To examine how smart technologies are currently used in Uganda's road transport.

To identify the benefits of smart transport systems.

To find the challenges that limit the use of digital tools.

To suggest ways to improve the adoption of smart transport technologies in Uganda.

1.4 Research Questions

1. How are smart technologies currently used in Uganda's road transport?
2. What are the main benefits of smart transport systems?
3. What challenges affect their use?
4. What can be done to improve the use of smart transport technologies in Uganda?

1.5 Significance of the Study

This study is important because it explains how Uganda can use digital tools to improve transport safety and efficiency.
It provides useful ideas for transport planners, government agencies, app developers, and policymakers.

Muresan et al. (2022) and Abubakar (2019) highlighted that smart systems help improve traffic control, reduce accidents, and save time.
The study will also support decision-making on how technology can improve sustainable and modern transport development in Uganda.

1.6 Scope of the Study

This study focuses on smart road transport in Uganda, especially in urban areas like Kampala where digital apps and road data systems are already used (Van der Waerden et al., 2020).
The study covers tools such as artificial intelligence, mobile apps, GPS, and other digital systems used in managing transport.
It does not include water, rail, or air transport.

1.7 Definition of Key Terms

- Smart Technology: Digital tools such as mobile apps, GPS, and AI used to improve transport.
- Road Transport: Movement of people and goods using vehicles such as cars, buses, and motorcycles.
- Intelligent Transport System (ITS): Technology used to manage traffic, improve safety, and reduce congestion.
- Efficiency: Doing transport activities faster, cheaper, and with better organization.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter reviews information from eleven research articles that discuss smart technology and its role in improving road transport.
The review is presented in themes that explain what smart transport is, how it is used in developing countries, how it is applied in Uganda, its benefits, challenges, opportunities, and research gaps.

2.1 Theme 1: Concept of Smart Technology in Transport

Smart transport refers to the use of digital tools to make road systems safer, faster, and better organized.
Abubakar (2019) reported that systems like GPS and mobile apps help transport managers monitor traffic and improve communication.

Kerzhner (2024) explained that artificial intelligence (AI) and real-time data are useful for controlling transport systems, although they require strong internet and proper technical support.
Muresan et al. (2022) added that smart tools help reduce pollution by avoiding unnecessary traffic delays.
Overall, smart technology connects people, vehicles, and data to create better transport systems.

2.2 Theme 2: Smart Transport in Developing Countries

Research shows that developing countries are using digital tools to solve transport problems such as congestion and poor planning.
Akinyemi et al. (2021) created a mobile-based system called MAGITS to help farmers and drivers share transport information easily.
Salon and Gulyani (2018) found that simple tools like smartphones can make a big difference by improving road planning and public transport safety.
These studies show that developing countries can benefit from low-cost and easy-to-use technologies.

2.3 Theme 3: Smart Transport in Uganda

Several studies show that Uganda has begun using smart technology, mainly in cities like Kampala.
Kasozi (2019) reported that SafeBoda improved safety and trust between motorcycle riders and passengers.
Van der Waerden et al. (2020) mapped informal transport routes using smartphones, helping city planners understand how people move in Kampala.
Mugisha (2019) explained that road management systems help reduce road accidents.
Nkurunziza (2021) found that digital tools support long-term urban planning.
These studies show that Uganda is slowly adopting smart transport solutions, especially through mobile apps and mapping tools.

2.4 Theme 4: Benefits of Smart Transport Technology

The reviewed studies show several benefits of using smart technology in transport.
Muresan et al. (2022) explained that smart systems reduce fuel use and environmental pollution.
Porter et al. (2020) found that mobile phones help drivers and passengers communicate faster.
Abubakar (2019) noted that digital tools improve coordination, saving time and making transport more reliable.
In summary, smart technology improves safety, efficiency, and sustainability in Uganda's transport sector.

2.5 Theme 5: Challenges of Smart Transport in Uganda

Despite progress, Uganda still faces many challenges.
Nkurunziza (2021) showed that transport planning is still weak and not well connected with digital systems.
Kasozi (2019) reported that many boda-boda riders cannot afford smartphones or internet data.
Porter et al. (2020) found that rural areas suffer from poor network signals.
Kerzhner (2024) added that AI systems need strong internet and skilled people, which Uganda lacks.
These challenges slow the adoption of smart technologies in Uganda.

2.6 Theme 6: Opportunities for Improvement

The reviewed studies also show opportunities for Uganda.
Muresan et al. (2022) suggested using low-cost smart tools that save energy.
Abubakar (2019) and Akinyemi et al. (2021) recommended combining mobile apps with intelligence systems to help government collect better traffic data.
Nkurunziza (2021) noted that improving digital policies and training can support smart transport growth.
These opportunities show that Uganda can improve its transport system if the right strategies are used.

2.7 Theme 7: Research Gaps Identified

Several gaps were identified in the reviewed literature:

Most studies focus only on Kampala, leaving out rural areas.

There is limited research on long-term performance of smart transport systems.

Few studies combine safety, planning, and environmental issues together.

There is little research on how smart technology can be expanded nationwide.

These gaps show that more research is needed to understand how smart transport can work in all parts of Uganda.

2.8 Summary

Smart technology has great potential to improve Uganda's road transport.
It can make transport safer, faster, and more organized.
However, challenges such as low funding, weak infrastructure, and limited digital skills still affect progress.
Uganda needs stronger policies, better training, and more investment to fully benefit from smart transport solutions.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter explains how I carried out the study on "Transforming Road Transport in Uganda Through Smart Technology."
It describes the research design, study area, target population, sample size, data collection, and data analysis.
The aim was to understand how smart technologies are helping to improve road transport in Uganda and what challenges still exist.

3.1 Research Design

I used a descriptive and qualitative research design.
This type of design helped me describe and explain how smart technologies are being used in Uganda's road transport.
The study focused on reviewing existing information from journal articles, reports, and case studies related to smart transport in Uganda and Africa.
I chose this method because it allowed me to understand real situations and experiences rather than only using numbers.

3.2 Study Area

The study focused on Uganda, mainly in urban areas such as Kampala, where smart transport systems are already being used.
Kampala was selected because many digital transport systems such as SafeBoda and road mapping projects are found there.
These examples show how technology is being used to improve transport organization and safety in Uganda.

3.3 Target Population

The target population included people and groups involved in Uganda's transport and technology sectors.

These include transport officials, boda-boda riders, app developers, road users, and city planners.
These groups were considered because they directly use or manage smart transport tools and systems.

3.4 Sample Size and Sampling Technique

Since this study is based on literature review, I used 11 published research articles related to smart transport in Uganda and Africa.
I applied purposive sampling, which means I carefully chose only the articles that focused on road transport and the use of smart technologies.
This helped me to collect only relevant and useful information for the research topic.

3.5 Data Collection Methods

I used secondary data collection methods.
This means I did not collect new data myself but instead used existing information from academic journals, books, and research databases like Google Scholar and ProQuest.
I selected and reviewed the 11 articles to gather key points about the use, benefits, and challenges of smart transport technologies.

3.6 Data Analysis

I used content analysis to study the information from the collected articles.
I read through each article and identified key ideas and patterns.
Then I grouped the information into main themes such as:

use of technology,

benefits,

challenges, and

possible improvements.

This method helped me to summarize the main ideas and understand the overall trend of smart transport in Uganda.

3.7 Ethical Considerations

I followed all ethical standards in my research.
I made sure to acknowledge all the sources I used and cited them properly using the APA 7th Edition format.
I did not copy or include any false information.
The study was done honestly, with respect for the work of other researchers.

3.8 Limitations of the Study

It is usually included in most research reports. It shows honesty and academic maturity.
It also makes your methodology stronger and more complete.

Here is the section you should add:

3.8 Limitations of the Study

This study was mainly based on secondary data, which means information was collected from already published articles and reports. Because of this, I was not able to collect new data directly from drivers, riders, or transport officials. The study also focused mostly on urban areas such as Kampala, since most of the reviewed articles covered these areas. Another limitation is that smart transport is still new in Uganda, so there were not many recent local studies available. Even with these limitations, the information gathered was useful for understanding how smart technology can be applied to improve road transport in Uganda.

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.0 Introduction

This chapter presents the main findings from the review of the eleven research articles.
The aim is to explain how smart technology is being used in Uganda's road transport, what

benefits it brings, the challenges faced, and the opportunities for improvement.
The findings are grouped into four themes:

1. Use of Smart Technology
2. Benefits
3. Challenges
4. Opportunities

4.1 Use of Smart Technology in Transport

Several studies showed that Uganda is slowly adopting smart transport tools, especially in urban areas.
Kasozi (2019) reported that the SafeBoda app helped organize motorcycle taxis by improving trust between riders and passengers.
Van der Waerden et al. (2020) used smartphones to map informal transport routes in Kampala, helping planners understand how people move around the city.
Abubakar (2019) explained that transport information systems help reduce confusion by improving coordination among road users.
Kerzhner (2024) added that AI can support traffic control and decision-making, although it requires strong digital systems.

These findings show that smart technology is already helping Uganda collect transport data, improve communication, and support better planning.

4.2 Benefits of Smart Technology

The reviewed studies agreed that smart technology brings many benefits to road transport.
Mugisha (2019) explained that digital road management systems help reduce accidents by providing real-time information.
Porter et al. (2020) found that mobile phones make communication between drivers and customers faster and more reliable.
Muresan et al. (2022) stated that smart tools reduce fuel usage and pollution by helping drivers avoid traffic jams.
Abubakar (2019) added that digital tools save time and make transport services more organized.

Overall, smart technology improves safety, efficiency, communication, and environmental sustainability.

4.3 Challenges Identified

Despite the benefits, all the studies showed that Uganda still faces major challenges in using smart technology.

Nkurunziza (2021) found that digital systems are not fully connected with transport planning.

Kasozi (2019) noted that many riders cannot afford smartphones or data bundles, which limits app usage.

Porter et al. (2020) reported that rural areas have poor network coverage, making digital tools difficult to use outside Kampala.

Kerzhner (2024) explained that AI and other advanced systems need strong internet and skilled workers—things Uganda still lacks.

These challenges show that Uganda needs better digital infrastructure, affordable technology, and more awareness before smart transport can grow fully.

4.4 Opportunities for Improvement

The reviewed articles also showed strong opportunities for Uganda to improve its transport system using smart technology.

Muresan et al. (2022) suggested using low-cost and energy-saving technologies to support sustainability.

Abubakar (2019) and Akinyemi et al. (2021) reported that combining mobile apps with intelligent transport systems can help government agencies make better decisions using real data.

Nkurunziza (2021) added that improving digital policies and giving training to transport workers can increase the success of smart transport projects.

These opportunities show that Uganda can greatly improve safety, traffic flow, and planning if it invests in technology and digital education.

4.5 Discussion Summary

The findings show that Uganda is slowly moving towards smart road transport, mainly through mobile apps, GPS, and road management systems.

These tools already provide safety, efficiency, and better planning.
However, the country still faces challenges such as poor digital infrastructure, low digital literacy, and high costs.
If Uganda invests in training, digital policies, and stronger internet systems, smart technology can transform its road transport and bring long-term benefits.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.0 Introduction

This chapter gives a short summary of what I found in my study, the conclusion I made, and my recommendations on how Uganda can improve road transport using smart technology.
The information in this chapter is based on what I learned from reviewing the eleven research articles about digital transport systems and smart technology in Uganda and other developing countries.

5.1 Summary of Key Findings

From the review, I found that smart technology is slowly changing how road transport works in Uganda.
Tools like mobile phone apps, GPS systems, intelligent transport systems (ITS), and artificial intelligence (AI) are helping to make transport safer, faster, and more organized.

Apps like SafeBoda have made motorcycle transport more trustworthy and easier to manage.
Digital road management systems are helping to monitor roads and prevent accidents.
Also, smartphone mapping projects in Kampala are helping planners understand traffic flow and design better routes.

However, there are still many problems.
Smart transport is growing mostly in cities like Kampala, while rural areas are left behind because of poor internet, limited smartphones, and low digital skills.
Other challenges include low funding, weak policy support, and limited awareness about the benefits of using digital transport tools.

5.2 Conclusion

From this research, I conclude that smart technology is very important in transforming Uganda's road transport.
It can make transport safer and more efficient by improving communication, planning, and data management.

Uganda has already made good progress with mobile apps and mapping tools, but there is still more work to be done.
For smart transport to fully succeed, the country needs stronger government support, better infrastructure, and public education about how to use these digital systems.

If Uganda continues to invest in technology and policy development, it can build a transport system that is modern, safe, and benefits everyone — both in cities and rural areas.

5.3 Recommendations

Based on the study, I recommend the following actions:

1. Increase Government Investment
   The government should invest more in internet networks, road data systems, and smart transport infrastructure.

2. Provide Digital Training
   Drivers, transport officers, and city planners should be trained on how to use mobile apps, GPS, and digital monitoring systems.

3. Develop Strong Policies
   The government should create laws that support digital transport innovation and ensure fair and safe use of new technologies.

4. Raise Public Awareness
   People should be sensitized about the importance of using smart transport apps and digital tools for safety and convenience.

5. Encourage Private Sector Partnership
   Technology companies and transport firms should work together to develop local and affordable smart transport solutions.

6. Support More Research
   More studies should be carried out, especially in rural areas, to find the best ways to expand smart transport beyond Kampala.

5.4 Final Thought

Smart technology gives Uganda a great chance to modernize its transport system.
If used well, it can reduce accidents, save time, and make travel easier and cheaper.
The future of Uganda's transport depends on how well the country uses digital tools to build a smart, safe, and sustainable road transport system.

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