UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY



PROJECT TITLE: WEB-BASED ROAD CAR TOW SERVICES

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DECLARATION

The undersigned authors, declare that this report titled “Road Car Tow Services” is our original work and research under supervision of Mr. Kitikoy Andrew Chemonges. The Authors, further declare that the information and results presented within this report are based on our own efforts and contributions. All external references, including books, articles, and websites, have been properly cited and acknowledged within the report.

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APPROVAL

This is to certify that this project report has been prepared under my supervision in accordance with the research guidelines issued by Uganda Institute of Information and Communications Technology.

MR. KITIKOY ANDREW CHEMONGES

Date……..

DEDICATION

The authors dedicate this report to their parents, a beacon of strength and resilience. Their endless sacrifices and boundless love have been the cornerstone of our journey. Their unwavering belief in our potential has been a driving force, and we are eternally grateful for their guidance, encouragement, and unwavering faith in our abilities.

To our families, friends, and mentors, who have stood by us through thick and thin, your camaraderie has turned challenges into triumphs. Your wisdom, encouragement, and camaraderie have made the journey memorable. Each interaction, conversation, and shared moment has been a guiding light.

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A special note of appreciation goes to our supervisor, whose leadership and mentorship have been invaluable throughout this report. His insights, encouragement, and unwavering support of providing us with the direction needed to navigate the challenges and opportunities that arose. We are grateful for his patience in clarifying doubts, his belief in our abilities, and his constant motivation to strive for excellence.

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LIST OF ACRONYMS

Apps	Application
GPS	Global Positioning System
IoT	Internet of Things
KCCA	Kampala City Council Authority
OBD-II	Onboard Diagnostics
UNRA	Uganda National Roads Authority
AI	Artificial Intelligence
SMS	Short Message Service
USSD	Unstructured Supplementary Service Data
IOS	Internet of service

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ABSTRACT

In Uganda, the rapid increase in the number of vehicles has been accompanied by a rise in traffic incidents, vehicle breakdowns, and parking violations, highlighting the need for an efficient and reliable road car tow service system. This project aimed to design and implement a Road Car Tow Service System tailored to the unique transportation challenges in Uganda, leveraging technology to improve accessibility, efficiency, and service delivery.

The developed system integrates modern technology with local infrastructure to provide a streamlined solution for roadside assistance, vehicle recovery, and towing services. The core objectives included enhancing service efficiency, reducing response times, and ensuring affordability for users. Key features of the system included:

1. Mobile and Web-based Platforms: A user-friendly application and web portal that allow drivers to request towing services, report incidents, and track service progress in real-time.
2. Geo-Location Integration: GPS-based functionality for accurate location tracking, ensuring timely responses and optimized route planning for tow trucks.
3. Service Categorization: Options for emergency towing, accident recovery, and vehicle relocation, tailored to user needs.
4. Payment Integration: Support for digital payments using mobile money, credit cards, and cash to ensure financial inclusivity.
5. Driver and Tow Operator Network: A robust system to connect drivers with verified tow truck operators, enhancing reliability and trust.
6. Data Analytics and Reporting: Tools for analyzing service demand, vehicle breakdown trends, and response performance, supporting decision-making for policy and service improvements.

The development of this system considered Uganda's specific challenges, including limited road infrastructure, varying network connectivity, and economic constraints. A phased approach was adopted, starting with major urban centers like Kampala and gradually expanding to other regions.

The implementation of the Road Car Tow Service System aimed to address pressing transportation issues in Uganda, improve road safety, and create employment opportunities for tow service

operators. By integrating technology with local practices, the system sought to provide an accessible, efficient, and sustainable solution for vehicle towing services, contributing to the overall enhancement of Uganda's transportation sector.

CHAPTER ONE: INTRODUCTION

This chapter presents the background, problem statement, and objectives of our project, scope, significance and justification.

1.1 Introduction

Uganda's road transport sector plays a critical role in the country's economy by facilitating the movement of people, goods, and services across various regions. However, the increasing number of vehicles on the roads has led to a rise in mechanical breakdowns, accidents, and traffic congestion particularly in urban centers like Kampala, Entebbe, and Jinja. One of the contributing factors to these challenges is the lack of an efficient and responsive towing service infrastructure.

Currently, many motorists in Uganda rely on informal towing service providers, often found by word of mouth or roadside assistance, which is unreliable, inconsistent, and largely unregulated. In emergency situations, delays in locating available tow trucks can lead to increased traffic jams, heightened accident risks, and prolonged inconvenience for road users. Moreover, the absence of a centralized platform limits transparency in pricing, accountability, and quality of service.

To address these challenges, this project proposed the design and implementation of a Web-Based Tow Service System tailored to Uganda's specific needs. The system aims to provide a real-time digital platform where vehicle owners can easily request towing services, and service providers can receive, manage, and respond to these requests efficiently. Leveraging modern web technologies and GPS-based location tracking, the system is expected to improve service delivery, enhance road safety, and formalize the towing industry in Uganda.

This project further contributes to the digital transformation of essential services by integrating technology with transportation management, ultimately providing a sustainable solution that supports motorists, towing professionals, and road authorities alike.

1.2 Background of the study

Uganda's road network is the backbone of its transport infrastructure, accounting for over 90% of the country's passenger and freight movement. As vehicle ownership continues to rise—especially in urban centers like Kampala, Wakiso, and Mukono—the frequency of vehicle

breakdowns, road accidents, and mechanical failures has increased significantly. These incidents often cause severe traffic congestion, road blockages, and, in some cases, fatalities. According to the Uganda Police Annual Crime Report (2022), over 20,000 road crashes were recorded, with a significant percentage linked to stalled or poorly handled broken-down vehicles on highways and urban roads.

Unfortunately, the response to such incidents is frequently delayed due to a fragmented and informal towing service industry. Most tow services in Uganda are run by independent operators who lack digital coordination, standardized pricing, or reliable communication channels with motorists. As a result, vehicle owners are often forced to rely on personal networks, local mechanics, or private individuals who may exploit their desperation. This creates not only a financial burden but also compromises road safety.

For instance, in Kampala Central, a single stalled vehicle during peak hours can block an entire lane, causing traffic backups for several kilometers. Without a fast, coordinated towing response, such situations can last for hours. Similarly, in remote districts like Gulu or Kabale, a vehicle breaking down on rural roads may be left unattended for an entire day due to the lack of available tow services nearby or the absence of a dispatch system.

The legal framework in Uganda does recognize the importance of towing. According to the Traffic and Road Safety Act (1998) and subsequent amendments, it is mandatory for vehicle owners to remove broken-down vehicles from public roads within two hours. Failure to do so results in fines and possible prosecution, with towing costs added to the penalty. Additionally, all towing service providers are required to register with the Ministry of Works and Transport (MoWT) to be legally recognized. However, enforcement remains a challenge due to the lack of a centralized digital system for request handling, monitoring, and accountability.

Globally, countries like Kenya, South Africa, and India have adopted mobile and web-based platforms that allow drivers to request towing services, locate the nearest provider, and make secure digital payments. Platforms such as TowMe (South Africa) and RapidTow (Kenya) are examples of successful digital towing service systems that combine real-time geolocation with customer service features. These systems have drastically improved response times and service reliability while formalizing an entire industry previously dominated by informal actors.

This study was therefore motivated by the urgent need to modernize Uganda’s towing service sector by building a Web-Based Tow Service System that is accessible, reliable, and efficient.

By incorporating mobile and web technologies, GPS tracking, and a secure database, the system addresses critical gaps in service delivery, improve emergency response, and contribute to safer roads and enhanced mobility across the country.

1.3 Statement of the Problem

The growing rate of car accidents and break downs on Ugandan roads has led to an increased demand for road assistance services, including car towing. Uganda's car tow service industry faces challenges like lack of standardization, slow response times, limited rural access, inadequate technology, road safety risks, and public distrust. Informal operations, unclear pricing, and poor service quality contribute to inefficiencies, while the absence of digital tools hampers convenience. To address these issues, a professional, regulated, and technology-driven system is needed to ensure reliable services, faster responses, improved accessibility, and enhanced road safety.

1.4 Objectives

1.4.1 General objective

The study aimed at developing a web-based road car tow service system in Uganda that provides real time access to tow services by the victims of breakdowns.

1.4.2 Specific objectives

The study was guided by the following objectives;

(i) To study how the car tow service providers will access their customers when delivering services.

(ii) To analyze the findings of the study in (i) above and determine the user and the system requirements for the web-based road car tow services system.

(iii) To design a web-based rad car tow service system for the clients in Uganda based on the user requirements identified in (ii)above.

(iv) To develop a web-based road car tow service system based on the design as in (iii) above.

(v) To test and validate the developed web-based road car tow service platform for the road tow service providers in Uganda in order to access their clients and ensure the user requirements identified in (ii) above are satisfied.

1.5 Scope

The Road Car Tow Service System is designed to address the challenges faced by vehicle owners, tow service providers, and road safety authorities in Uganda. The system aimed at enhancing service accessibility, operational efficiency, and affordability while creating a reliable infrastructure for vehicle recovery and towing services. The scope is divided into the following dimensions;

Geographical Scope

The website is accessible countrywide, allowing tow service providers to allocate their clients when delivering services.

Technical scope

The platform is web based accessible through desktop and mobile devices core functionalities include:

i) User profile tools.
ii) Automated job assignments.
iii) Real time GPS tracking.
iv) Service tracking.
iv) Payment integration.

Time scope

The project started in November 2024, with the conception of the project followed by preparation of the project proposal. Thereafter the authors identified user requirements which guided the development of the system.

Proposal writing commenced in _____ and project presentation followed in _____.

The Development of the system started in _____ and ended with a complete system successfully defended in June, 2025.

In summary the project was conducted between November, 2024 and June, 2025.

1.6 Significance of the study

A web-based road car tow service platform for Uganda holds a significant value for various stakeholders within the towing industry:

Tow truck operators

The platform provide a wider accessibility allowing tow service providers to show their work to a global audience. This increases exposure and leads to greater recognition and sales opportunities.

Vehicle owners

For individuals needing towing services, a dedicated website offers convenience and accessibility. They can quickly request services, tack the arrival of the help and make secure payments.

Auto repair shops

Local garages benefit from partnerships with towing services. When vehicles are towed to their facilities, they gain new customers who may require repairs or services.

Insurance companies

Insurers can work with road car service website to provide their clients with reliable towing options. This can enhance customer satisfaction and Royalty, as policy holders appreciate having access to trustworthy services during emergencies.

1.7 Justification

The proposed Road Car Tow Service System was essential for addressing critical challenges in Uganda's growing transportation sector. The justification for this system was based on its ability to enhance road safety, improve service efficiency, and contribute to socio-economic development. Below are the key reasons why this system is necessary and valuable;

Increasing Vehicle Population: With more vehicles on the road, traffic congestion caused by stalled or illegally parked cars was frequent issue. This system provides a structured solution to mitigate such challenges.

Limited Accessibility: Traditional tow services are often fragmented, unreliable, or difficult to access, especially during emergencies. A centralized, technology-driven system ensures that services are available to all users conveniently.

CHAPTER TWO: LITERATURE REVIEW

In this chapter, various ideas, finished theses, generalizations, and other relevant information are presented. The purpose of including these is to provide familiarity with and reference to similar studies that are related to the present study. This chapter serves as a valuable resource for understanding the context, and gathering insights in the current research.

2.1 Introduction

In Uganda road car tow services are an essential component of the country's transportation eco system. These services provide critical support in vehicle breakdowns, accidents and roadside emergencies, ensuring minimal disruptions to traffic flow and enhancing road safety. Many countries around the world have used technology to solve transport and road safety problems. In countries like South Africa, Kenya, India, and Nigeria, digital tow service systems have helped reduce delays caused by broken-down vehicles and accidents. These systems allow people to request tow services through mobile apps or websites. This review looks at similar systems and studies, and how they relate to Uganda’s needs.

The use of Web and Mobile Systems in Transport services, according to Ghosh & Banerjee (2020), mobile and web-based transport systems help improve response time, reduce manual work, and improve communication between service providers and users. For example, ride-hailing services like Uber and Bolt have made it easy for people to request rides using their phones. These same ideas can be used in towing services allowing drivers to request tow trucks quickly and easily.

Digital Tow Services in Other Countries for example in South Africa, a platform called TowMe was developed to help motorists find nearby tow trucks during breakdowns or emergencies. TowMe uses GPS to locate the user and send the nearest tow truck automatically. A similar system in Kenya, called RapidTow, allows users to get help within minutes using a mobile app. These platforms have improved road safety and reduced traffic jams caused by stalled vehicles (TowMe Report, 2021).

In India, Singh et al. (2019) studied how GPS tracking and online booking helped improve the towing industry. They found that customers were more satisfied when they could see the tow truck's location and arrival time. The study also showed that service providers were able to manage more requests with less confusion.

Uganda's Road and Towing Challenge: Uganda, most towing services are informal and uncoordinated. Many tow trucks are not registered, and there is no easy way for motorists to request help. This leads to delays, high costs, and poor service. The Uganda Traffic and Road Safety Act (1998) says that broken-down vehicles must be removed from the road within two hours. But this is hard to enforce without a proper system to manage and track tow requests.

According to the Uganda Police Annual Report (2022), many accidents and traffic jams were caused by vehicles that broke down and stayed on the road for too long. A better system is needed to allow fast reporting and response to such incidents.

Several studies show that a web-based system can make tow services faster, cheaper, and more professional. A study by Adewale & Kazeem (2018) in Nigeria found that using a web platform for tow services improved communication between users and providers, reduced fraud, and increased user satisfaction. GPS also helped service providers plan better routes and save time.

A web-based system would also help the Ugandan government and agencies like KCCA and the Ministry of Works and Transport monitor the industry better, register providers, and track performance.

In Uganda, the regulation and management of road car towing services are primarily governed by the Roads Act, 2019, which is overseen by the Ministry of Works and Transport. Kampala Capital City Authority (KCCA) also plays a role in enforcing these regulations within the capital city. Roads Act, 2019: This Act mandates the removal of broken-down or abandoned vehicles from public roads. Specifically, Section 58 is to the effect that:

> *"Vehicles in urban areas must be removed within 2 hours while vehicles in rural areas must be removed within 6 hours. Failure to comply results in fines up to 96 currency points (UGX 1.92 million) or imprisonment for up to 4 years, or both. Vehicles left unattended for more than the specified time are considered abandoned and may be towed to the nearest police station yard at the owner's expense".*

Enforcement and Implementation

Ministry of Works and Transport: This Ministry is responsible for developing regulations to operationalize the Roads Act, 2019. In July 2023, a meeting convened by the Speaker of Parliament highlighted the need for these regulations, particularly concerning the towing and auctioning of abandoned vehicles. The Ministry committed to table these regulations by August 2023.

- Uganda National Roads Authority (UNRA)**:** UNRA has taken proactive steps by deploying at least eight tow vehicles to remove abandoned vehicles from highways, as part of efforts to enhance road safety.
- Kampala Capital City Authority (KCCA)**:** KCCA enforces towing regulations within Kampala. In 2020, the Uganda Police set official towing charges for vehicles and motorcycles in the Central Business District: UGX 30,000 for motor vehicles and UGX 15,000 for motorcycles.

From the studies and examples above, it is clear that a web-based tow service system can help improve road safety, reduce delays, and bring order to the towing sector in Uganda. Learning from other countries and using modern tools like GPS, mobile apps, and digital records can help Uganda build a strong and efficient towing service system that works for everyone.

2.2 State-of-practice

The towing industry in Uganda has witnessed growth in recent years. However, the sector is still facing challenges including;

Lack of visibility: Many potential customers cannot find towing services quickly during emergencies. The website is able to enhance online visibility allowing customers to easily find the services via search engines.

Limited reach: Traditional advertising may not attract a broad audience. A website integrated with SEO (Search Engine Optimization) and digital marketing campaigns can reach wider audience.

Payment processing issues: Customers may not have cash or prefer digital pay methods. A website can offer secure online payment options making the transaction process seamless (smooth)

2.3 State-of-the-art/Similar existing systems

The state of the art in road car tow services represents the most advanced practices, technologies, and innovations in the industry. These advancements aimed to improve efficiency, customer satisfaction, and environmental sustainability while addressing traditional challenges in vehicle towing.

Advanced Technologies in Roadside Assistance

Digital Platforms and Mobile Apps

Real-Time Booking and Tracking: Apps like safe boda Add-on, rescue enable customers to request services, track tow trucks.

AI-Powered Dispatching: Artificial intelligence is used to allocate the nearest available tow truck, optimizing response times and reducing operational costs.

Predictive Analytics

Telematics systems integrated with vehicles analyze data to predict breakdowns and proactively recommend towing services before a failure occurs for example Onboard diagnostics (OBD-II) systems in connected cars can automatically notify towing services in case of critical failures

2.4 Comparative evaluation

This comparative evaluation assesses the key methods, technologies, and operational models used in road car towing services. It compares traditional approaches with modern advancements to identify their strengths, weaknesses, and overall suitability across various contexts.

. Evaluation Criteria

1. Efficiency: Response time and operational reliability.
2. Cost: Service affordability for customers and operational sustainability for providers.
3. Customer Satisfaction: Transparency, convenience, and service quality.
4. Technological Integration: Use of tools like GPS, and website for better operations.
5. Scalability: Ability to handle demand in different geographic and operational contexts.
6. Sustainability: Environmental impact of towing operations.

Table 1: Comparative Evaluation Table

SYSTEMS	**FEATURES**			
	GPS tracking	Available to all users	Payment integration	Real time service request
Insurance company road-side assistance	No	No	No	No
KCCA/Police towing services	No	No	No	No
Safe boda emergency Add-on	Yes	No	No	Yes
Web based tow system (current system)	Yes	Yes	Yes	Yes

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter presents the methodological adopted for this study on web based road car tow services. It outlines the system study, system analysis, system design, system development and system testing and validation. The methodology is designed to address the research objectives and answer research questions effectively.

3.2 System study

To gather system requirements and understand the current towing landscape, we conducted observations, interviews, online study and document reviews. We interacted with key stakeholders, including traffic officers, local towing service providers, and vehicle owners. These interactions helped us analyze the shortcomings of the existing informal towing service system and informed the design of a more.

3.2.1 Observation.

The authors used own naked eyes to observe what is happening in public places especially where traffic congestion is common. This helped the authors acquire adequate information about what is happening in those places and it is from that information we were able to come up with the idea of developing and implementing our system.

To collect data on road car tow services is a practical way to understand how these services operate in real-world setting. Here is how you can do it effectively:

3.2.2 Structured observation:

This method uses a pre-defined checklist or form to track specific aspects. You can collect data like;

(i) Time and location of each tow

(ii) Reasons for towing (e.g. illegal parking, accident and breakdown)

(iii) Response time (how long it takes the tow truck to arrive)

(iv) Interaction between tow operators and vehicle owners

(v) Type of vehicle being towed.

3.2.3 Unstructured observation:

Observers take note freely without a rigid format. This is useful for;

- Noting behavioral patterns such as how drivers react

- Understanding tow operator routines
- Observing any conflict or unusual events

3.2.4 Technology-Assisted Observation:

Using tools like;

- CCTV footage or traffic cams
- GPS trackers on tow trucks
- Dash cam or mobile apps to log events in real time.

3.2.5 Online research

The authors used internet to find related research work from different researchers who tried to make similar systems like ours. This helped the authors to develop and suggest more strategies, procedures, and approaches which were useful during the implementation of our system. It also helped us to get adequate knowledge about the components we used during the implementation of our system.

3.2.6 Document review

Authors carried out search and reviewed relevant documents such as those from KCCA, Ministry of works and transport to gather comprehensive facts and information containing the details about the challenges, recommendation of the existing transport system.

The data analysis process for this involved both qualitative methods to comprehensively address the research objectives. For the quantitative, data was collected through questionnaires, statistical analysis which was performed using appropriate software such as Excel. This analysis included descriptive statistics to summarize and present the data, including frequencies, percentages, means, and standard deviations. These statistics helped in understanding the general trends and patterns.

Thematic analysis was used to analyze qualitative data from open-ended questions and interviews, focusing on identifying and categorizing common themes related inactive road car tow services. Observational data integrated with these findings to provide a comprehensive view of the current system's strengths and weaknesses. The combined results from both qualitative and quantitative were interpreted in the context of the literature review and theoretical

framework, guiding the development of practical recommendations for improving inactive road car tow services.

3.2.7 Data collection tools/instruments include;

The study used questionnaire and interview guide to collect comprehensive data on inactive road car tow services. The questionnaire, featuring both closed and open-ended questions, gathered data on current practices, challenges and stakeholder perception regarding storage facilities, retrieval procedures and system satisfaction. Semi-structured interviews were conducted using an interview guide with open-ended questions. Additionally, an observation checklist was used to systematically assess storage conditions, organization methods and retrieval processes. These tools were designed to align with the research objectives and relevant, valuable data collection.

Interview guide: A standardized interview guide ensured consistency in data collection across all road car tow service user interviews.

Observation tool: Authors used their own naked eyes to observe what is happening in public places especially where traffic congestion is common.

Online survey tool: A user-friendly online survey platform like google forms were used to collect survey data.

Document analysis tools: Relevant documents were used such as those from KCCA document and UNRA.

3.3 System analysis

The authors talk about the system requirements and the tools used during the system analysis.

The use case diagram was used to identify the main users of the system and the interaction between those users and the system's functionalities. It helped break down the system into simple processes performed by:

Motorists; Registering, requesting tow services and tracking service status.

Tow service providers; Logging in, viewing and accepting requests and updating service status.

Administrators; Managing users, service provider, complaints and generating reports.

3.4 System Design

System design include system interface layout, system architecture, user flow and data base structure.

Tool used:

Draw Entity Relationship Diagrams which will describe use of data object description. This provided an indication of how data was transformed as it moved through the system and it depicted the functions that transformed the data flow.

Flow chart:

It outlines the key process steps from when a user logs in, to when a towing service is requested, matched, dispatched, completed and confirmed.

3.5 System Development

Tools include;

Programming languages and frameworks: The specific languages and frameworks were chosen for development approach for example. HTML, CSS, and JavaScript for web development

Development environment: An integrated development environment (IDE) sublime text or visual studio code was used for code writing and debugging.

Front-end development tools: Libraries and frameworks for example reactJS**,** Bootstrap were used to design the user interface for a visually appealing and user-friendly platform.

Backend development tools: Node.js with Express.js, WebSocket and authentication like OAuth for user authentication.

Database management system: A database system MySQL was used to store platform data (tow service provider profiles, tow service information, user accounts.

System interfaces include;

Tow service dashboard: A dedicated interface for car tow service providers to manage their profiles, upload tow services and set services.

Collector interface: An interface for collectors to browse tow services view tow service provider profiles.

Admin panel: A secure interface for platform administrators to manage user accounts, monitor platform activities, and perform system maintenance.

3.6 System testing and validation

3.6.1 Testing methodology includes;

A composition of unit testing, integration system, and user acceptance testing was employed to secure the platform functions as intended.

Unit testing verified the functionality of individual software components.

Integration testing ensured all components work shamelessly together.

User acceptance testing involved targeted user groups road car tow service and collectors interacting with the platform and providing feedback.

3.6.2 Test data matrix includes;

A test data matrix was developed to outline various test scenarios with specific input data and expected results. This ensured comprehensive testing of all platform functionalities.

This methodology outlines a systematic approach to developing a web based road car tow service system. By employing user centered research methods and appropriate development tools, for the project.

The comparative analysis of road car tow services highlights a clear evolution from traditional, manually operated systems to highly advanced, technology-driven solutions. This transition is being driven by the increasing demand for efficiency, transparency, scalability, and environmental sustainability;

(i) Traditional Services remain relevant in localized, low-tech markets but face challenges due to limited scalability, inconsistent quality, and lack of transparency.

(ii) GPS-Based Systems offer significant operational improvements through optimized routing and resource management but require substantial investment and skilled personnel.

(iii) Digital Platforms represent the forefront of innovation, GPS, and real-time communication to provide fast, transparent, and customer-friendly services. These systems are setting new industry standards for convenience and efficiency.

(iv) Eco-Friendly and Autonomous Systems signal the industry's future, aligning with global sustainability goals. However, widespread adoption is contingent on infrastructure development and reduced technology costs.

(v) Subscription-Based Services cater to frequent users with bundled benefits, providing consistent service but lacking flexibility for occasional needs.

CHAPTER FOUR: SYSTEM STUDY, ANALYSIS AND DESIGN

4.1 Introduction

In this chapter, authors presents the system study, analysis, and design for the web-based tow service system in Uganda. This included the tools used for system analysis, use case diagrams, flow charts, data flow diagrams (DFDs), and entity relationship diagrams (ERDs). These tools guided the modeling of both the functional and non-functional aspects of the system.

4.2 System study

To gather system requirements and understand the current towing landscape, Authors conducted interviews, observations, and document reviews. Authors interacted with key stakeholders, including traffic officers, local towing service providers, and vehicle owners. These interactions helped us analyze the shortcomings of the existing informal towing service system and informed the design of a more.

4.2.1 Interviews

we interviewed traffic police officers, local tow truck operators, and vehicle owners who had experienced breakdowns. The interviews were conducted face-to-face, and short notes were taken to capture pain points, service delivery gaps, and suggestions for improvement. These insights were instrumental in identifying key system requirements and features for a better service experience.

4.2.2 Document review

With support from stakeholders in the transport and law enforcement sectors, Authors reviewed documents such as the Traffic and Road Safety Act (1998), the Road Traffic Act (2004), and operational manuals from Ministry of works and transport and KCCA. Authors also examined reports and guidelines that related to road clearance and emergency response procedures. These documents guided the development of system interfaces to align with legal and regulatory standards.

4.2.3 Observation

Field observations were conducted to understand how vehicle breakdowns are currently handled on Ugandan roads. Authors observed response times, roadside conditions, communication between officers and service providers. This real-time understanding of processes allowed us to

identify system features such as GPS tracking, automated dispatch, and instant notifications for both users and service providers.

4.3 Functional requirements

User registration and login

Tow request form with vehicle and location details

Real-time tracking of service request status

Matching users with nearby available tow trucks

Admin dashboard for monitoring requests and user activity

Service provider interface to accept or reject requests

Transaction history and feedback system

4.4 Non-functional requirements

System was to be accessible via mobile and desktop browsers

High availability and fast response time

Secure user authentication and data encryption

Scalable to support high user traffic

GPS integration for accurate dispatching

Compliance with national transport regulations

4.5 System analysis

Many tow service providers in Uganda had failed to reach the customer's satisfaction through their poor services for example delayed service provision leaving broken cars deserted on roads causing traffic. This project was therefore intended to solve the problems highlighted in chapter one Problem Statement by designing a Web-Based Road Car Tow Service System. This chapter Authors talked about the system requirements and the tools that we used during the system analysis as shown below.

4.6 System requirements

Since a large number of people were going to use this system, it was to serve each user according to the requirements.

The system was divided into the following main modules:

4.6.1 User Module

Register/Login

Requested tow service (selected location and car issue)

Tracked service provider in real-time

Viewed request history

4.6.2 Service Provider Module

Register/Login

Accepted or rejected tow requests

Updated status (on the way, arrived, completed)

Viewed request history

4.6.3 Admin Module

Managed user accounts

Viewed system reports and logs

Monitored active and completed service requests

Formed and identified system design needs.

4.6.4 Use-case diagram

This diagram showed the system's actors and their interactions:

Vehicle owner requested and tracked tow.

Admin validated and dispatched a tow truck.

Tow operator received job requests, updated tow status.

Admin oversaw all transactions and user activity.

The system facilitated clear, secure, and efficient communication among all parties, which improved the towing process across Uganda.

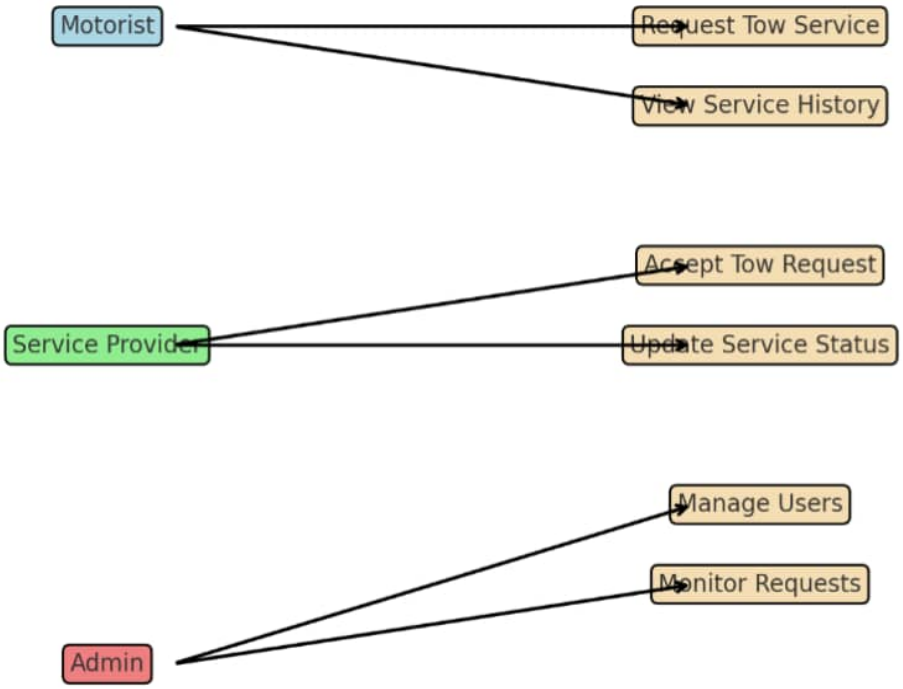


Figure 1 shows a use case diagram

4.7 System design.

The system design consisted of a data flow diagram, an entity relationship diagram and data dictionary all helped us in the critical design process of the system.

4.7.1 Flow chart.

It outlines the key process steps from when a user logs in to when a towing service is requested, matched, dispatched, completed and confirmed.

Data flow chart

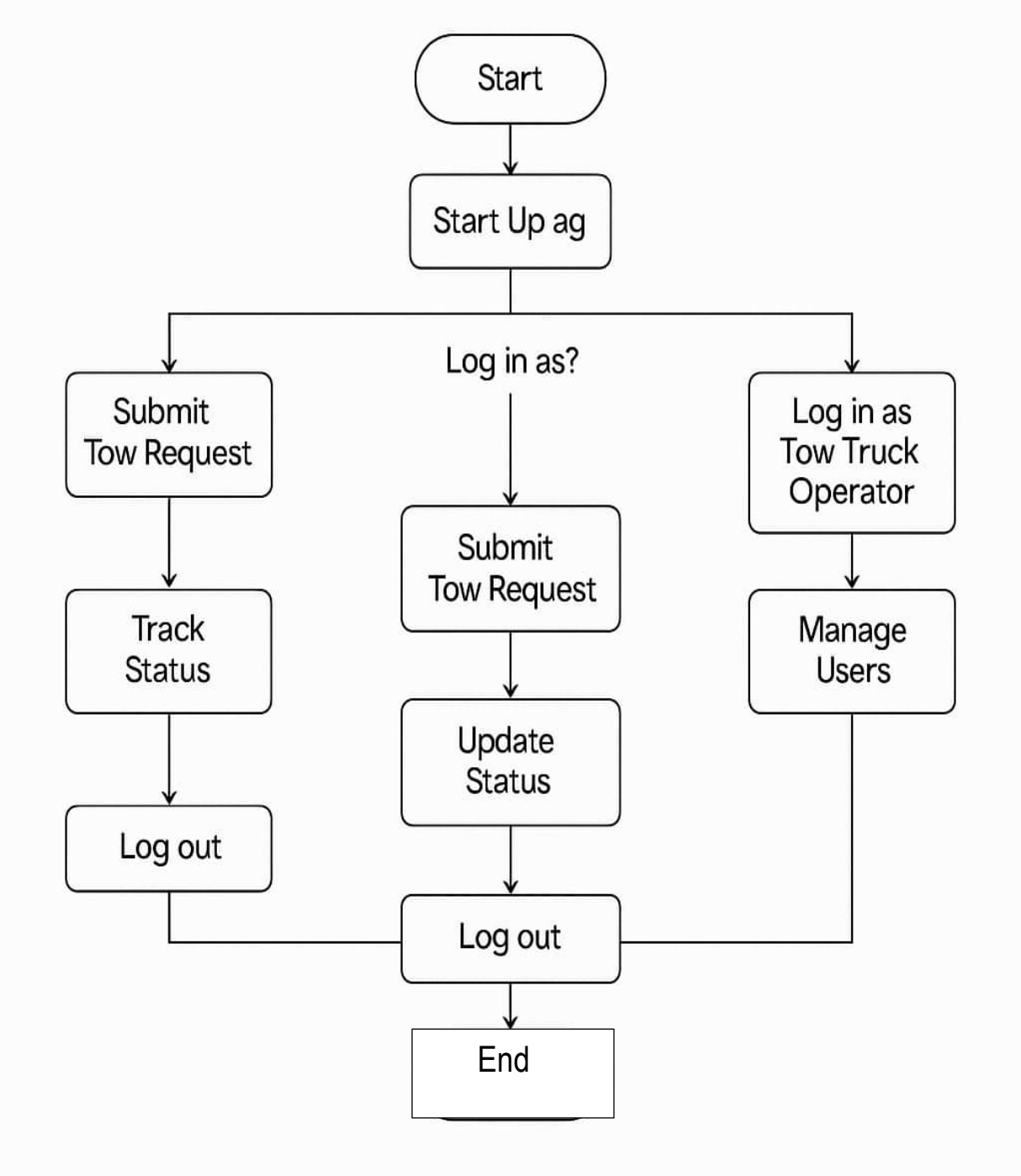


Figure 2 Flow chart

4.7.2 Entity - relationship diagram:

This depicted relationship between data objects. The attribute of each data objects noted in the entity relationship diagram could be described using a data object description. relationship diagram served two

purposes:

1. It provided an indication of how data are transformed as they moved through the system.
2. It depicted the functions that transformation the data flow.

Data Objects:

A data object was a representation of almost any composite information that had to be understood by the software.

By composite information, Authors meant something that had a number of different properties or attributes.

Attributes: Attributes defined the properties of a data object and take on one of three different characteristics. They could be used to:

i. Name an instance of data object.
ii. Described the instance.
iii. Made reference to another instance in other table.

Relationships:

relationship defined the relevant relationships.

Data objects were connected to one another in a variety of different ways. Authors can define a set of object Cardinality and Modality:

Cardinality:

The data model had to be capable of representing the number of occurrences of objects in a given relationship. The cardinality of an object relationship pair is:

One-To-One (1:1):

One-To-Many (1: N):

An occurrence of object 'A' related to one and only one occurrence of object 'B' and vice versa.

One occurrence of object 'A' related to one or many occurrences of object 'B' but an occurrence of object 'B' related to only one occurrence of object 'A'.

Many-To-Many (M: N):

An occurrence of 'B' and an occurrence of 'B’ related to one or many occurrences of " A'.

Modality:

The modality of a relationship was zero if there was no explicit needed for the relationship to occur or the relationship is optional. The Modality is one if the occurrence of the relationship is mandatory.

The object relationship pair could be represented graphically using the Entity Relationship Diagrams. set of primary components are identified for the Entity Relationship Diagram, they included:

Attributes

i. Relationships and
ii. Various Type Indicators.
iii. The primary purpose of the Entity Relationship Diagram was to represent data objects and their relationships.

Entity relationship diagram

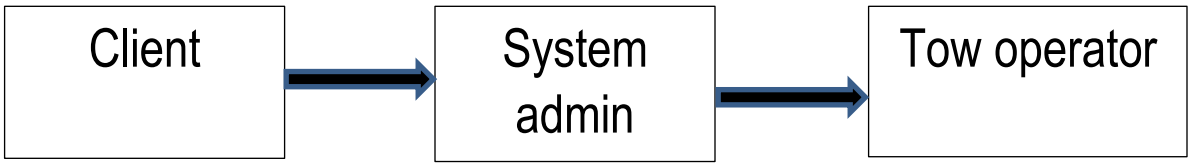


Figure 3 Entity relationship Diagram

Clients submits a tow request.

System admin manages all entities (users, trucks and requests).

Tow operator handles tow assignments.

4.8 Data dictionary

Here we gave a few table descriptions of different system data dictionaries of interface used as below;

4.8.1 User Table

Field	Type	Description
username	VARCHAR	Login name
Phone no.	INT	Unique ID for each user
destination	VARCHAR	User location
Service type	VARCHAR	Nature for Service needed
Pick up time	TIME STAMP	Time of service

4.8.2 Tow Request Table

Field	Type	Description
request_id	INT	Unique ID for each request
user_id	INT	Reference to Users table
provider_id	INT	Assigned provider ID
location	TEXT	Location of car breakdown
issue type	VARCHAR	Nature of the car issue
status	VARCHAR	'pending', 'accepted', 'completed'
request time	TIMESTAMP	Time of request

4.8.3 Log Table

Field	Type	Description
log_id	INT	Unique log entry ID
action	TEXT	Action performed
timestamp	TIMESTAMP	Time of the action
actor_id	INT	User who performed action

CHAPTER FIVE: SYSTEM DEVELOPMENT, TESTING AND VALIDATION

5.0 Introduction

This chapter represents system development, testing and validation.

There were many car breakdown incidents on the roads in Uganda, this section included the results of how the web Based Road Car tow system looked like and how it operated as shown below;

5.1 The user interface

The term user interface referred to the geographical appearance of the application. To what it looked like. This is an important part of the development for a WEB Based Road Car Tow Service system in Uganda. This page was created using HTML, CSS for designing the interface and php plus JavaScript for creating connectivity to database on the user table. It allowed the system user to make a request by providing their name, phone number and their destination and also truck their request.

The figure below demonstrated the user interface page.

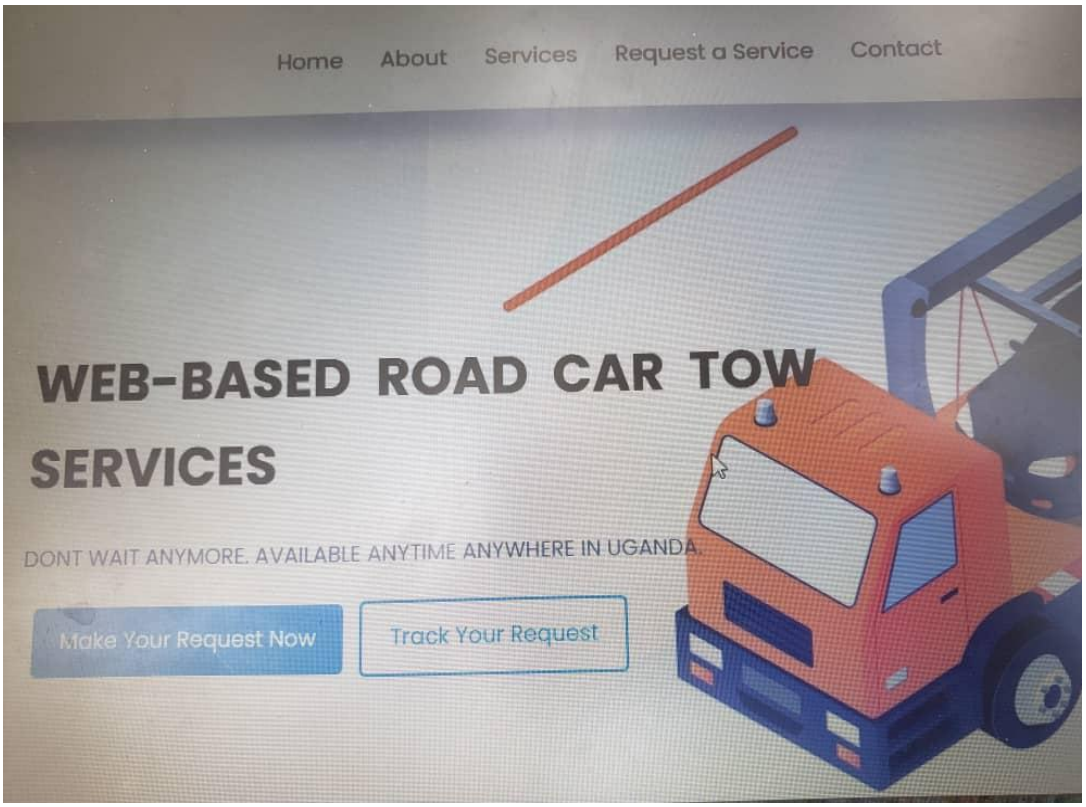


Figure 4 User interface

Service request

The user requests tow service by entering their details for example their name, phone number, location and service type.

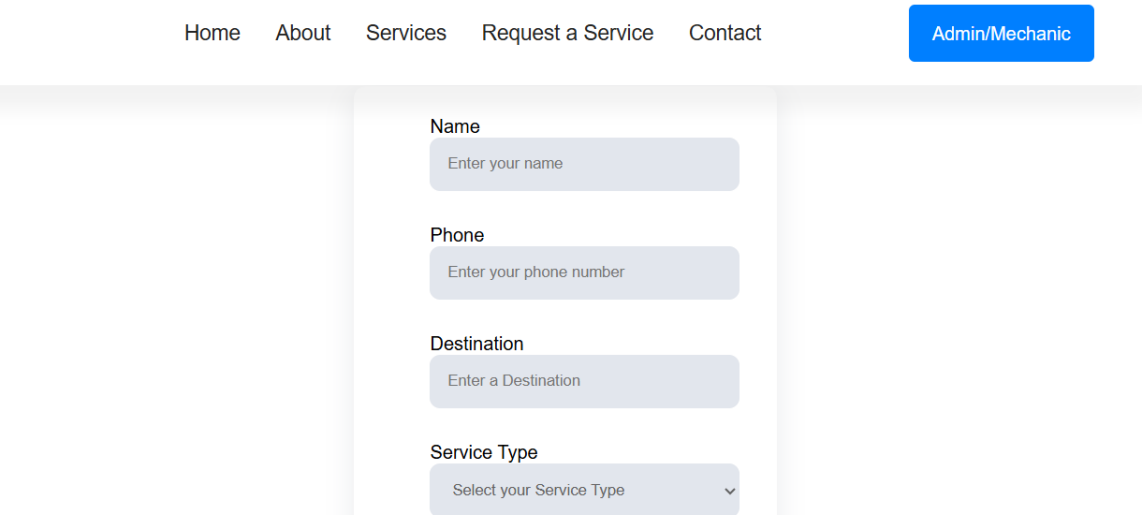


Figure 5 service request

Payment integration

After entering the first details, the client proceeds with the payment process by entering account details after choosing a bank and the payments are made using banks like Stanbic, DFCU then payments can also be made using credit cards.

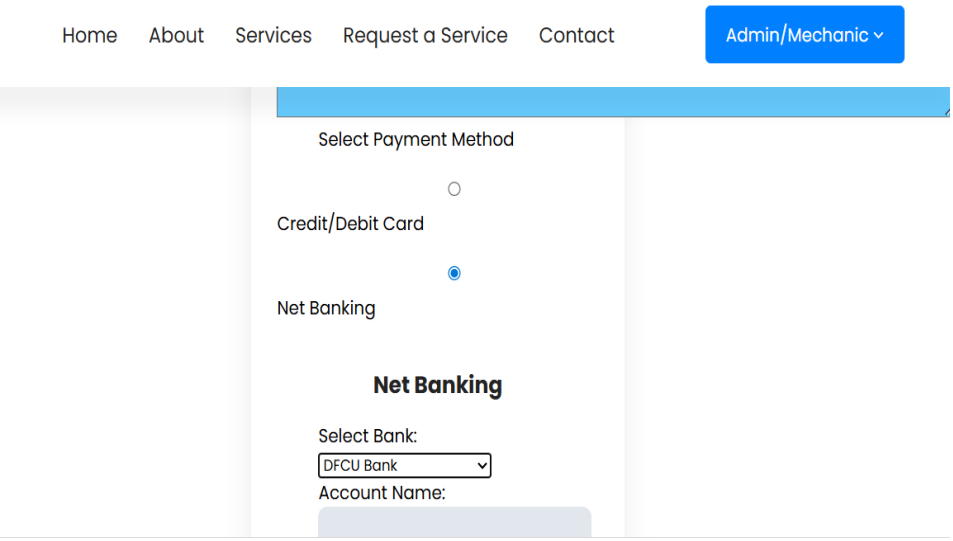


Figure 6 payment integration

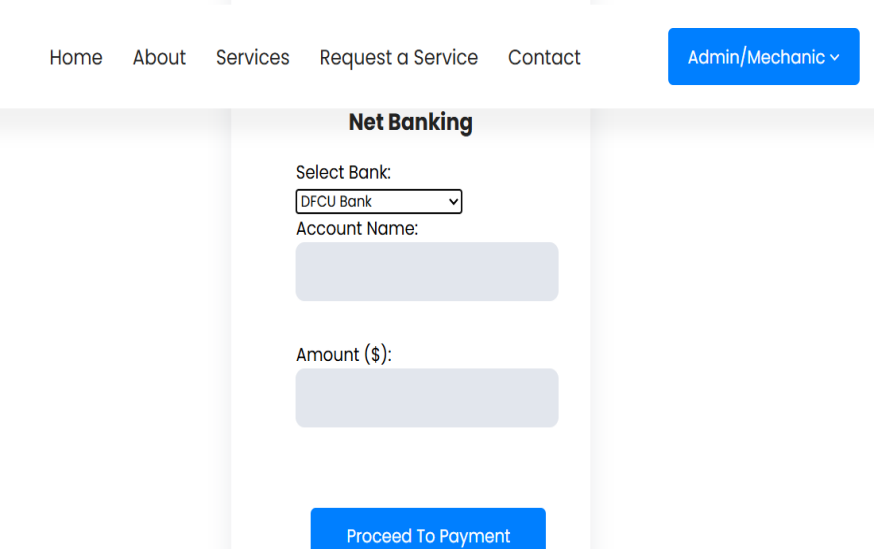


Figure 7

Tracking service

The client can track the service requests by entering his or her phone number.

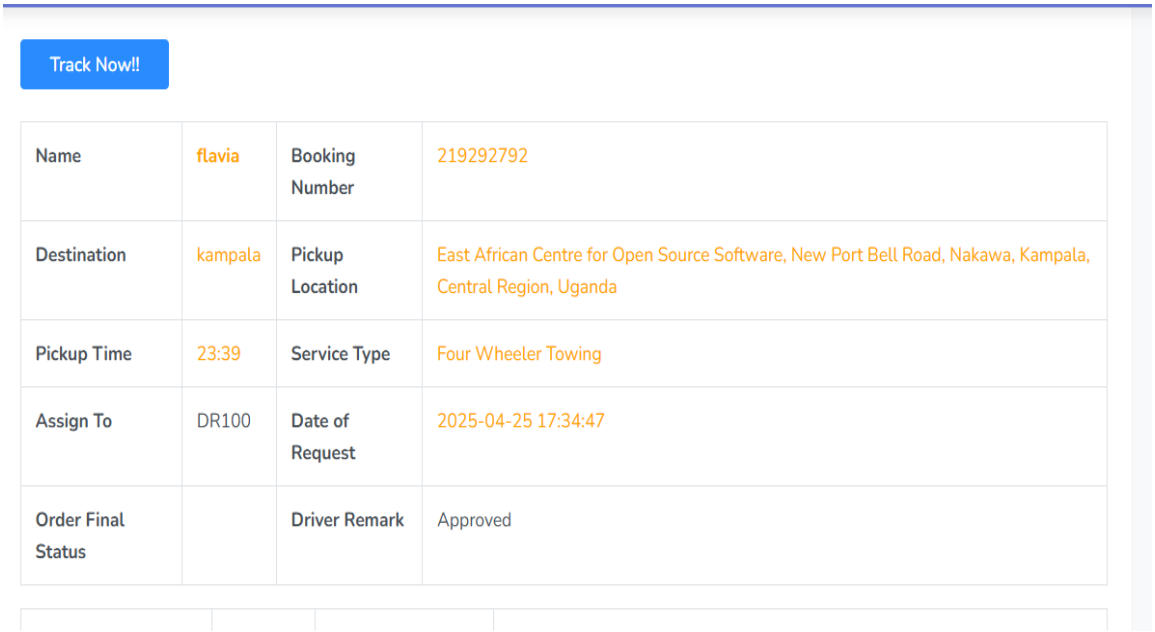


Figure 8 tracking a service

5.3 Admin system interface

This is the authentication page for administrators.

1. Admin login

The admin in this instance logs into the system using his user's name and a password of atleast eight characters and the system directs him or her to the dash board.

The image below illustrated the Admin login page.

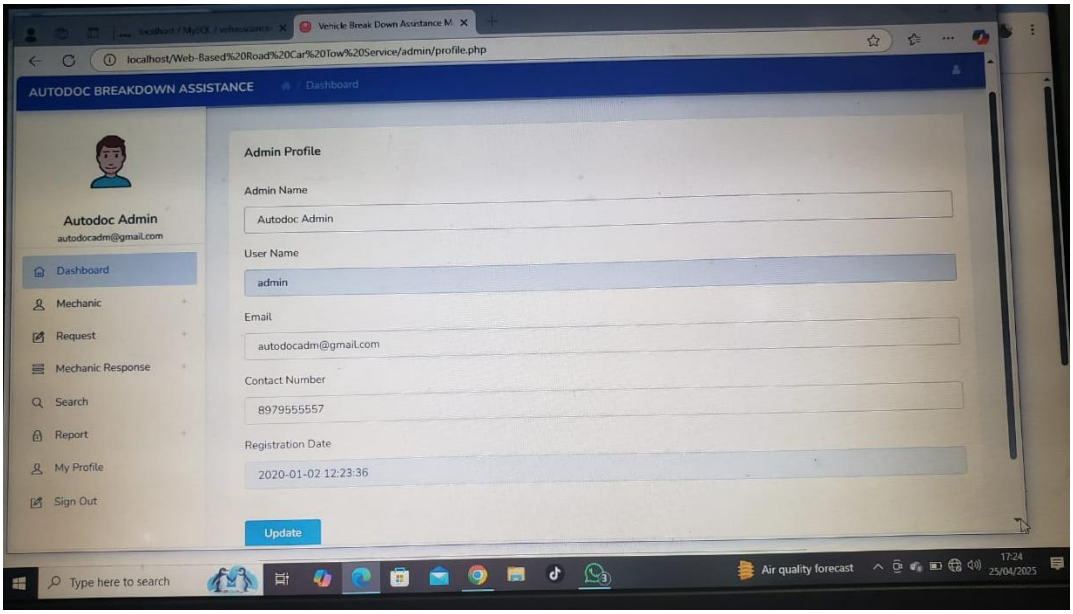


Figure 9 admin system interface

Admin view page

The admin was able to view, managed requests and assigned requests to the available drivers

The figure below demonstrated the Admin view page and functions.

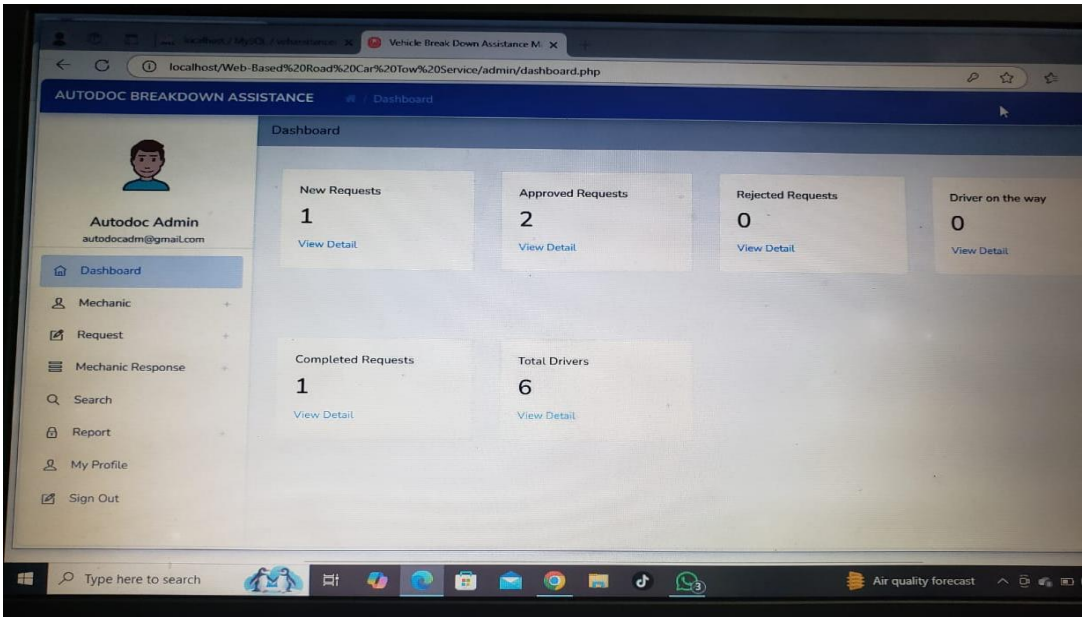


Figure 10 Admin view page

5.4 System Testing

Testing was conducted throughout the development process to ensure the system met its functional and non-functional requirements. Several types of testing were used:

5.4.1 Unit Testing

During the unit testing Authors tested different parts of a WEB Based Road Car Tow service system such as the log in page, request page, Admin dashboard among others to ensure proper performance of the system. During this tasting Authors were successfully able to log into the system without any failures as the system was able to be logged into as Admin, user and Tow operator.

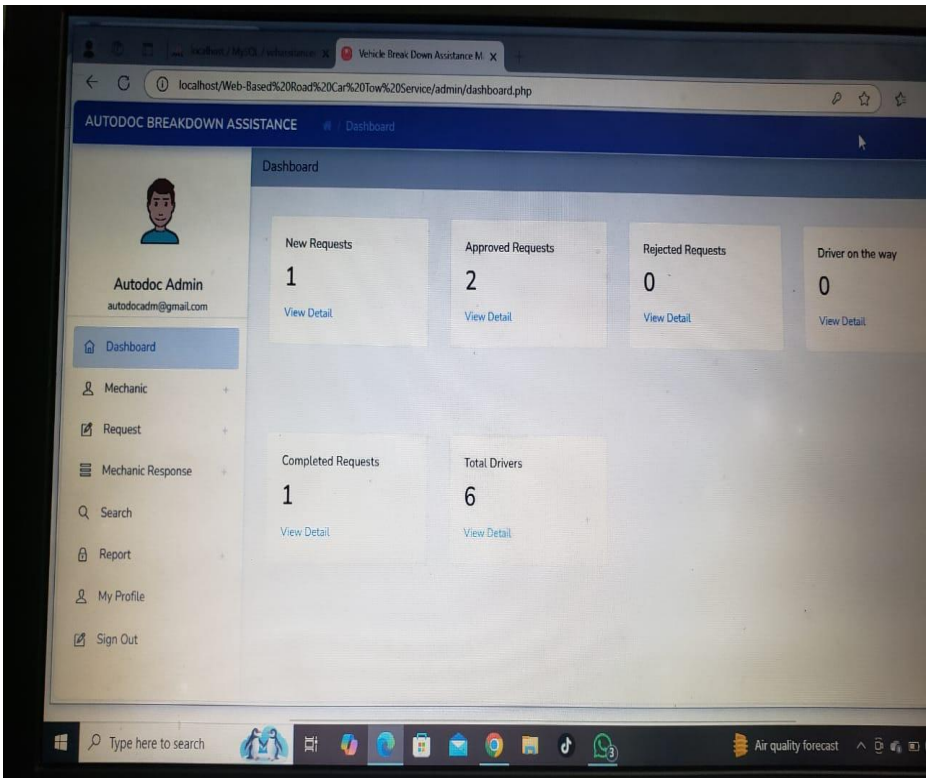


Figure 11-unit testing

5.4.2 Integration Testing

Authors integrated each unite, tested and came up with a fully functional system that improved the nature of the tow service system in Uganda.

5.4.3 Usability Testing

A group of potential end-users included drivers and admin staff tested the system and provided feedback. Results showed that the interface was intuitive, and the system could be used with minimal training.

5.4.4 Performance Testing

Tests were run to check how the system responded to multiple simultaneous requests. The system maintained stable performance under a simulated load of 20 concurrent users.

5.5 System Validation

Validation ensured that the system met the objectives and requirements outlined in the initial analysis phase.

5.5.1 Validation Techniques

- Requirement Traceability Matrix (RTM): Cross-checked each feature against user and system requirements.
- User Acceptance Testing (UAT)**:** Conducted with a sample of target users who evaluated whether the system met their needs.
- Error Logs and Bug Fixes**:** All reported bugs during UAT were documented and resolved, followed by regression testing.

5.5.2 Validation Results

The system passed all major validation checks with the following outcomes:

Test Case	**Expected Result**	**Actual Result**	**Status**
User Registration	New user created, confirmation email sent	Success	Passed
Service Request	Tow service request submitted and tracked	Success	Passed
Tow Provider Acceptance	Provider accepts request, location shown	Success	Passed

Test Case	Expected Result	Actual Result	Status
Admin Monitoring	Real-time overview of all active jobs	Success	Passed
Unauthorized Access Attempt	Redirect to login page	Success	Passed

CHAPTER SIX: DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

6.1 Discussion

The findings of the project showed that most motorists in Uganda, especially in busy divisions like Nakawa, faced challenges accessing timely and reliable tow services. This aligns with previous literature that highlighted the informal nature of the towing industry, poor coordination, and lack of real-time support. The implementation of a web-based platform addressed key issues such as delayed response time, lack of transparency in pricing, and limited accessibility. These findings support the reviewed literature which emphasized the importance of using digital tools, like mobile apps and GPS, to modernize tow service delivery.

Furthermore, the feedback from users and service providers during testing confirmed the need for a centralized and regulated system. These results confirm the assumptions made during the needs assessment and validate the design and development of the proposed system

6.2 Conclusion

This project successfully designed, developed, and tested a Web-Based Road Car Tow Service System aimed at improving road safety and transport services in Uganda. The system met its objectives by enabling motorists to request tow services in real time, giving tow providers a platform to manage requests, and offering administrators control over user activities. The implementation of GPS tracking and a simple user interface contributed to faster service delivery and user satisfaction. The project contributes to solving the problem of breakdown-related road congestion and offers a scalable solution that can be adopted nationally.

6.3 Recommendations

Based on the project findings and outcomes, the following recommendations are made:

(i) The Ministry of Works and Transport should adopt and support digital tow service platforms to regulate the industry and improve road safety.

(ii) More public awareness campaigns should be conducted to educate motorists about using the web-based system.

(iii) Tow service providers should be trained in digital tools and registered on the platform to expand service coverage.

(iv) The platform should be continuously monitored and upgraded to integrate new features such as emergency rescue services, insurance claims, and automatic traffic reports

(v) Partnerships with telecom companies should be explored to provide SMS/USSD services for users without smartphones.

6.4 Further research

Future researchers can extend this system by:

(i) Developing a mobile application version for Android and iOS to improve accessibility.

(ii) Integration with insurance companies, police traffic departments, and emergency medical services can create a more comprehensive transport safety solution.

(iii) Use of AI and machine learning to predict demand and dispatch tow trucks more efficiently.

(iv) National database of registered service providers can be created to support policy-making and regulation**.**

(v) Using MTN and AIRTEL mobile money for payments

REFERENCES

Adewale & Kazeem (2018). Research on digital solutions in road management

Banerjee & Ghosh, (2020). Smart systems for vehicle assistance and traffic control. Research report

Enrique (2018) “Uganda's National Transport Master Plan,” pp. 1-14. Kampala: Ministry of Works and Transport

Ministry of works and Transport (2020), National Transport Policy. Kampala: Government of Uganda

Nalumansi E. J. B. Jemina (2021), “Kampala Capital City Road Safety Strategy. (pp. 1-33). Kampala Capital City Authority.

Singh et al (2019). A study on public service digitization in developing countries. (Research paper)

Skowron, M & Kochel, A. (2016), Tow service and vehicle recovery systems. Transport Engineering. Journal.

Uganda National Road Authority (2023), Annual road maintenance article. Kampala: UNRA

Uganda Road Fund (2008), Mandate and Activities of the URF. Kampala: Government of Uganda

APPENDICES

Questionnaire for Web-Based Vehicle Tow Service System in Uganda

Section A: Background Information

1. Name (Optional): _____

2. Age group:

Under 18 ☐

18–30 ☐

31–45 ☐

46–60 ☐

Over 60 ☐

3. Occupation:

☐ Driver

☐ Vehicle owner

☐ Law enforcement (e.g. Police, KCCA, UNRA)

☐ Government official

☐ Towing service provider

☐ Other: _____

4. Do you own or frequently drive a vehicle in Uganda?

Yes ☐

No ☐

Section B: Experience with Towing Services

5. Have you ever had a vehicle towed in Uganda?

Yes ☐

No ☐

6. If yes, who towed your vehicle?

Police ☐

KCCA ☐

UNR ☐

Private company ☐

Not sure ☐

7. Were you satisfied with the towing experience?

Very satisfied ☐

Somewhat satisfied ☐

Neutral ☐

Dissatisfied ☐

Very dissatisfied ☐

8. What problems (if any) did you experience during the process? (Tick all that apply)

Lack of communication ☐

High fees ☐

Delayed recovery ☐

Confusing process ☐

No receipt/proof of service ☐

Rude or unprofessional staff ☐

Other: _____ ☐

Section C: Digital System Awareness and Preferences

9. What devices do you commonly use to access the internet? (Tick all that apply)

Smartphone

Tablet ☐

Laptop ☐

Desktop computer ☐

I rarely use the internet ☐

10. What features would be useful in a towing service platform? (Tick all that apply)

Report a broken-down or abandoned vehicle ☐

Track towed vehicle location ☐

Receive SMS/email updates on vehicle status ☐

View towing charges ☐

Pay online for towing and release fees ☐

Contact customer support or file complaints ☐

View towing history ☐

Other: _____ ☐

11. How would you prefer to be notified when your vehicle is towed?

SMS ☐

Email ☐

In-app notification ☐

Phone call ☐

Any of the above ☐

12. Would you trust a government-managed online system for towing services?

Yes ☐

No ☐

Maybe ☐

Section D: Feedback and Suggestions

13. What challenges do you anticipate with a towing services?

……

……

14. What suggestions do you have for the design and development of a web based tow service system?

……

……