AUTO AID: A LOCATION-BASED ROADSIDE ASSISTANCE SYSTEM IN UGANDA CASE STUDY: KAMPALA METROPLITAN AREA

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A Centre of Excellence in the Heart of Africa

Declaration

We declare that this project report entitled *AutoAid: A Location-Based Roadside Assistance System in Uganda,* is our original work and has been carried out by us under the guidance of Mrs.Mukalere Justine.

This work has not been submitted to any other institution for the award of any academic qualification and all sources of information, data and materials used in this project have been duly acknowledged and referenced in accordance with academic standards. Therefore, we take full responsibility for the content presented in this report.

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Abstract

This project presents the design and development of AutoAid, a location-based roadside assistance system aimed at improving emergency response and vehicle support services in Uganda. The study addresses key challenges such as delayed assistance, lack of verified service providers, and poor coordination during vehicle breakdowns and road accidents, which contribute to increased road fatalities, congestion, and economic losses.

A mixed-methods research approach was employed, incorporating interviews, questionnaires, and observation to gather requirements from motorists and service providers. The system was designed and developed using modern technologies including Kotlin for the Android mobile application, React for the web platform, Node.js for the backend, and MongoDB for data management. The system integrates GPS-based location tracking to connect users with nearby service providers in real time.

The developed system enables motorists to request assistance services such as towing, mechanical repair, fuel delivery, and ambulance support through a mobile application, while service providers and administrators manage requests via a web-based platform. System testing results indicate that Auto Aid improves response time, enhances service accessibility, and promotes transparency through features such as real-time tracking, notifications, and user feedback mechanisms.

The findings demonstrate that Auto Aid provides an effective, reliable and scalable solution for addressing roadside emergencies in Uganda with the potential to improve road safety and support through t the integration of digital technologies in the transport sector

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List of Abbreviations

- GPS – Global Positioning System
- API – Application Programming Interface
- UI – User Interface
- AI – Artificial Intelligence
- JWT – JSON Web Token

CHAPTER ONE:

Introduction

The transport industry is one of the fastest growing sectors in Uganda and plays a crucial role in trade, mobility and economic development. As the number of vehicles continues to increase, the demand for efficient vehicle maintenance and repair services has also increased. However, road safety in Uganda remains a major challenge due to multiple road insecurities like vehicle mechanical failures such as brakes, fuel shortages, vulnerabilities of theft like abandoned vehicles and life threatening conditions like accidents or medical situations.

In Uganda's urban areas such as Kampala, Mukono and Wakiso experience heavy traffic congestion and increasing cases of vehicle breakdowns on major roads like the Nkumba road crush(*New Vision,* 2024, April 17) . These incidents not only disrupt transport operations, but also cause accidents and environmental pollution. The situation is worsened by limited access to qualified mechanics, unreliable roadside assistance, and the lack of digital platforms that link vehicle owners to trusted service providers. In many cases, drivers are forced to walk long distances to find help or call personal mechanics who may be at afar distance which results in wasted time, financial loss and frustration.

Vehicle maintenance in Uganda is largely reactive rather than preventive, meaning that most repairs are done after breakdowns occur. This approach increases vehicle downtime, reduces efficiency and shortens service life proving that urgent vehicle service can be needed at any time of the day. Government agencies and organizations also spend substantial amounts on vehicle repairs due to lack of proper maintenance management systems. For example, the Uganda Revenue Authority (URA) spent over UGX 6.4 billion in three years repairing only 61 vehicles, averaging UGX 77 million per vehicle (Business Focus, 2023). Such costs highlight the urgent need for a more efficient and accountable maintenance management system.

Uganda’s Traffic and Road Safety Act (1998) and the Road Act (2019) require vehicle owners to promptly remove broken-down vehicles from the roads to ensure safety and reduce congestion. Failure to comply attracts penalties, including fines of up to UGX 1,920,000 or imprisonment (Nile Post, 2023). Despite these laws, compliance remains low due to the absence of breakdown assistance platforms or limited awareness of the service providers.

The Auto Aid project is therefore based on the need to develop a digital, integrated and responsive system that addresses these persistent gaps by connecting drivers to nearby garages, mechanics and gas stations. The main objective of Auto Aid is to design and implement service management system that enables vehicle owners and road users to access on demand emergency services as soon as they are realised.

The system will provide mechanic, towing, ambulance and fuel panels alongside location based tracking which will ensure service provider are able to locate the service seeker on request as well as allow service seekers being able to navigate for the nearest service provider .

Background of the Study

The global transport industry's role in growing economies by enabling the movement of people and goods is extremely important. As countries continue to experience urbanization and motorization, many countries are turning to digital technology including mobile apps to implement efficient roadside assistance service systems. Road-side assistance service systems allow motorist to request emergency services such as towing, mechanical repairs and fuel deliveries, all in real-time, thereby increasing safety and reducing wait time.

In under-developed and developing regions such as Africa the transport industry is expanding at a rapid rate but the challenges associated with the expansion are significant. These challenges include poor infrastructure; vehicle breakdowns' limited availability of reliable roadside assistance. The Integration of Information and Communication Technology with transport systems presents a primary solution to improving service delivery and enhancing road safety.

In Uganda, road transport is the dominant mode of mobility accounting for the majority of passenger and goods movement. According to national transport data, Uganda had approximately 1.88 million registered motor vehicles as of 2021 and this number continues to grow due to increased urbanization and economic activity (Uganda Driver Licensing System). Additionally, the rise of commercial transport services such as taxis and boda bodas has significantly increased road usage especially in urban centers like Kampala.

Although Uganda has been growing, it still does not have a well-organized or trustworthy roadside assist service. Instead, whenever a vehicle breaks down, drivers rely on informal support groups, mechanics who work on the side of the road and peers (the people they know personally). Research has shown that the majority of Ugandans do not know about or know how to reach existing emergency response services. In fact, in a survey of Ugandan citizens, only 5% of respondents indicated that they would reach out to emergency response services for help when an emergency occurs. The vast majority of Ugandans (95% of respondents) do not know the toll-free number for calling emergency medical help and most of them rely upon other people who happen to be around or they would drive directly to hospitals asking for help. The result of the lack of awareness about emergency assistance services contributes to a delay in the time it takes an individual to receive assistance in an emergency situation such as access to surgeries or ambulances. The entire environment is inefficient, unreliable and sometimes unsafe especially when attempting to locate emergency assistance, particularly at night. This creates the need for the creation of a mobile application that can provide an instant connection between a motorist and service providers they can trust to provide the assistance they require.

Problem Statement

Uganda is facing a growing crisis in terms of road safety and response, characterized by increasing accident rates, fatalities, delayed response and lack of coordination between the victims and the responders causing a major health and economic threat to the country (Uganda Police, 2025).

Road traffic accidents led to an estimated 5,144 fatalities and 20,664 injuries in the country in 2024, translating to an average of 14 fatalities per day (Uganda Police, 2025). The boda boda as transportation is the most affordable means of public transport in urban and peri-urban locations like Mukono. Apparently boda boda transport sector has also had the highest number of deaths up to 2,396 out of 5,144 deaths resulting from boda bodas (47% of all deaths, Uganda Police, 2025, WHO, 2023) because of their susceptibility in addition to the lack of enforcement of safety requirements and compliance. Reckless driving such as speed, unsafe overtaking and irresponsible riding account for 44.3% of all traffic accidents which shows significant behavioural and regulatory deficiencies associated with motorcycle use (Uganda Police, 2025). Additionally, poor maintenance of vehicles (mechanical issues such as brake failure) was a significant contributor to 15% to 20% of the accidents reported in 2024 (Uganda Police, 2024; Min of Works and Transport, 2023).

Despite this, Uganda has no centralized system that connects accident victims with services in real time. Road users often depend on informal networks, strangers on the road or previous calls to get help from a service provider creating long wait times for assistance, possible deaths that did not need to occur, secondary crashes due to people stopping to help, theft of vehicles and goods from vehicles and increased traffic congestion (Kiggundu, 2022; Uganda Red Cross Society, 2024). Service providers also experience difficulties in locating accident sites, navigating through traffic and confirming accidents to provide effective assistance (Nkurunziza et al., 2023).

Economically, crashes cost UGX 4.4 trillion (USD 1.2 billion) annually about 5% of GDP through lost productivity, medical bills and strained resources (Economic Policy Research Centre, 2023; Uganda Police, 2025, p. 10). Families lose breadwinners, businesses face disruptions and rising vehicle or motorcycle use in growing towns widens the gap in roadside and emergency support (Ministry of Works and Transport, 2024).This fragmented system intensifies insecurity, fatalities and inefficiencies as transport demand surges.

OBJECTIVES

General Objective

To design and develop a reliable, location-based digital roadside assistance system that improves emergency response and vehicle support services for road users in Uganda.

Specific Objectives

- To collect and analyse user requirements by using interviews , questionnaires, and observation in order to understand the challenges faced by motorists and service providers during roadside emergencies .
- To design and develop a reliable, location-based digital roadside assistance system that improves emergency response and vehicle support services for road users in Uganda .
- To design and develop a mobile and web-based system using technologies such as Kotlin, React, Node.js, and MongoDB that enables motorists to request assistance instantly using GPS-based location tracking and connects them to nearby service providers.
- To test and evaluate the system to ensure improved response time, efficiency, transparency, and accountability, through features such as service tracking, status updates, notifications, and user ratings

Project Scope

AutoAid focuses on the design and development of a digital platform that connects road transport users to roadside assistance services. This project is based on Kampala and the Kampala Metropolitan Area in Uganda, due to the high number of vehicles and frequent roadside breakdown incidents experienced in this region. The project involves developing a mobile application and a web-based platform aiming to facilitate requests for services such as mechanics, towing, fuel and health emergency assistance.

The system will include functionalities such as user registration and authentication, location-based service provider identification, service request management and digital subscriptions integration for service providers. This mainly concentrates on the analysis, design, development and testing of the system to ensure that it is effective for the transport sector and road safety.

Significance of the System.

AutoAid helps provide better access to emergency services along the roadside in Uganda by digitally connecting service seekers with verified mechanics and emergency responders in case of vehicle breakdowns or any other emergencies with services like towing,mechanics, fuel and ambulances integrated.

The project also improves roadside emergency response time by enabling motorists to request assistance instantly through a mobile application supported with real-time location tracking allowing service providers to easily identify the exact location of motorists and respond faster on demand.

The system also promotes transparency and accountability in service delivery by providing features such as service tracking, status updates and user rating mechanisms. These features will help ensure that motorists receive reliable and trustworthy services while also encouraging service providers to maintain high standards of service delivery.

In addition this project contributes to the adoption of digital solutions in the transport and emergency response sectors embracing the use of technology in Uganda.

CHAPTER TWO: LITERATURE REVIEW

Introduction

This chapter reviews existing literature related to roadside assistance systems, mobile applications and technology driven solutions for vehicle and roadside emergencies. The review provides information on how digital platforms have been applied globally , in Africa and identifies gaps in Uganda as well as establishes the theoretical and practical foundation for developing AutoAid.

The Evolution of Roadside Assistance: From Motor Clubs to Platform Ecosystems

Global Perspective

Roadside assistance services have been widely implemented in developed countries, providing services such as towing, emergency repairs, battery jumpstarts and fuel delivery. Companies like AAA in the United States and RAC in the United Kingdom offer comprehensive platforms combining mobile apps, GPS tracking and customer support to ensure rapid response to vehicle breakdowns(News Report, 2021). These systems leverage technology to:

•Connect motorists to verified service providers

•Provide estimated arrival times

•Enable real-time tracking of service requests

•Offer transparent pricing

Studies show that integrating technology improves service efficiency, reduces response time and enhances customer satisfaction(Smith & Jones, 2020).

African Context

In Africa, mobile technology has been instrumental in bridging gaps in transport services. For example:

In East Africa roadside assistance platforms such as Rescue.co have emerged to address vehicle breakdown challenges by connecting users to professional service providers offering services like towing, battery support and emergency repairs within short response times (Rescue).

South Africa: Automobile Association (AA) provides 90+ years of rescue; National Fleet Assist (NFA) focuses on commercial vehicles; RoadMech offers breakdown towing

MechanicFinder (Nigeria): Successfully uses GPS to locate mechanics but is limited to mechanical repairs, excluding critical complementary services like towing or fuel delivery, which are common needs in roadside emergencies (Adeyemi, 2022).

Ugandan Context

Reports indicate that Kampala alone has over 1 million registered vehicles, with frequent breakdowns due to aging vehicles, traffic congestion and poor maintenance practices (udls.co.ug). Despite high vehicle density, there is no formal, centralized or technology-driven roadside assistance platform, leaving motorists vulnerable.

Local Platforms in Uganda

- **SafeBoda**
  Provides ride-hailing services with trained riders, GPS tracking, and safety measures. However, its primary focus is transportation rather than roadside emergency services.
- **Ryda UG**
  Offers boda, taxi and delivery services with real-time tracking and verified drivers but does not specialize in emergency roadside assistance.

However these platforms aim at transportation which creates a unique opportunity for AutoAid to provide a reliable, accessible and safe platform for motorists who face road uncertainties.

Market Gap

Platform	Country	Features	Limitations
AAA	USA	Towing, battery jumpstart, app tracking	Membership required, not available in Africa
RAC	UK	24/7 roadside assistance,app tracking	Limited to UK
Rescue.Co	Kenya	Towing,battery jumpstart,app tracking	Limited to accident responses only

Why Choose AutoAid? (Competitive Advantage)

Feature / Criteria	AAA (USA)	RAC (UK)	Rescue.Co (Kenya)	AutoAid (Uganda)
Available in Uganda	✕	✕	✕	✅
No Membership Required	✕	✕	✅	✅
Towing Services	✅	✅	✅	✅
Battery Jumpstart	✅	✅	✅	✅
Fuel Delivery	✕	✕	✕	✅
Ambulance/Emergency Support	✕	✕	Limited	✅
Connects to Nearby Mechanics	✕	✕	Limited	✅
GPS Real-Time Tracking	✅	✅	✅	✅
Mobile & Web Access	✅	✅	Limited	✅
User Ratings & Transparency	✕	✕	✕	✅
AI Support / Smart Assistance	✕	✕	✕	✅
Localized for Ugandan Needs	✕	✕	✕	✅

Theoretical and Conceptual Frameworks for Digital Service Platforms

The conceptual design of AutoAid is underpinned by several interconnected theoretical domain

The Platform Business Model

AutoAid is fundamentally a multi-sided platform, an intermediary that creates value by facilitating interactions between distinct user groups: vehicle owners and service providers (mechanics, tow truck drivers and more). The core theory here is that platforms reduce transaction costs the costs of search, negotiation and monitoring that are exceptionally high in informal markets (Hagiu Wright, 2015). For a Ugandan motorist, finding a trustworthy mechanic is a significant challenge where as for a mechanic, finding a reliable stream of customers is equally difficult. AutoAid aims to mitigate these frictions.

Location-Based Services (LBS) and Real-Time Coordination

The technological core of the system relies on Location-Based Services (LBS). The effectiveness of LBS in improving emergency response is well-documented in logistics and supply chain literature. As implemented in platforms like Uber, real-time tracking and dynamic allocation algorithms are proven to reduce wait times and optimize resource utilization (Kamar Galloway, 2019). For Auto Aid, this translates directly to the core objective of getting help to a stranded motorist faster than through informal, ad-hoc methods.

Trust and Verification in Digital Marketplaces

A critical barrier to adoption in informal economies is the lack of trust. Research on digital marketplaces consistently shows that features like verified provider profiles, user ratings, and service guarantees are essential for building consumer confidence (Botsman Rogers, 2010). While existing informal systems have no mechanism for this, AutoAid’s design, which includes mechanic photos, verification status and user feedback, is directly informed by this theoretical understanding of trust-building in digital transactions.

CHAPTER 3

This chapter explains the methodology that was used to design and develop the AutoAid system. It describes the research approach, data collection methods, system design, development tools, and testing procedures used during the project. The aim of this methodology was to ensure that the system was developed in an organized and efficient way to address the problem of delayed roadside assistance.

Research Approach

The project followed a system development approach that focuses on designing and implementing a technological solution to a real-world problem. The development process involved identifying the problem, designing the system, implementing the solution, and testing the system to ensure that it performs effectively.

This approach made it possible to gradually build the AutoAid system and ensure that each component functions properly before integrating it into the final system.

Data Collection Methods

To better understand the problem of vehicle breakdowns and delays in roadside assistance, several data collection methods were used.

Observation

Observation helped identify common situations where drivers face difficulties when their vehicles break down. Many drivers struggle to find immediate help, especially when they are in unfamiliar areas.

Interviews

Interviews were conducted with vehicle users to understand their experiences during roadside emergencies. The responses indicated that most drivers rely on phone calls or personal contacts to seek help, which often leads to delays

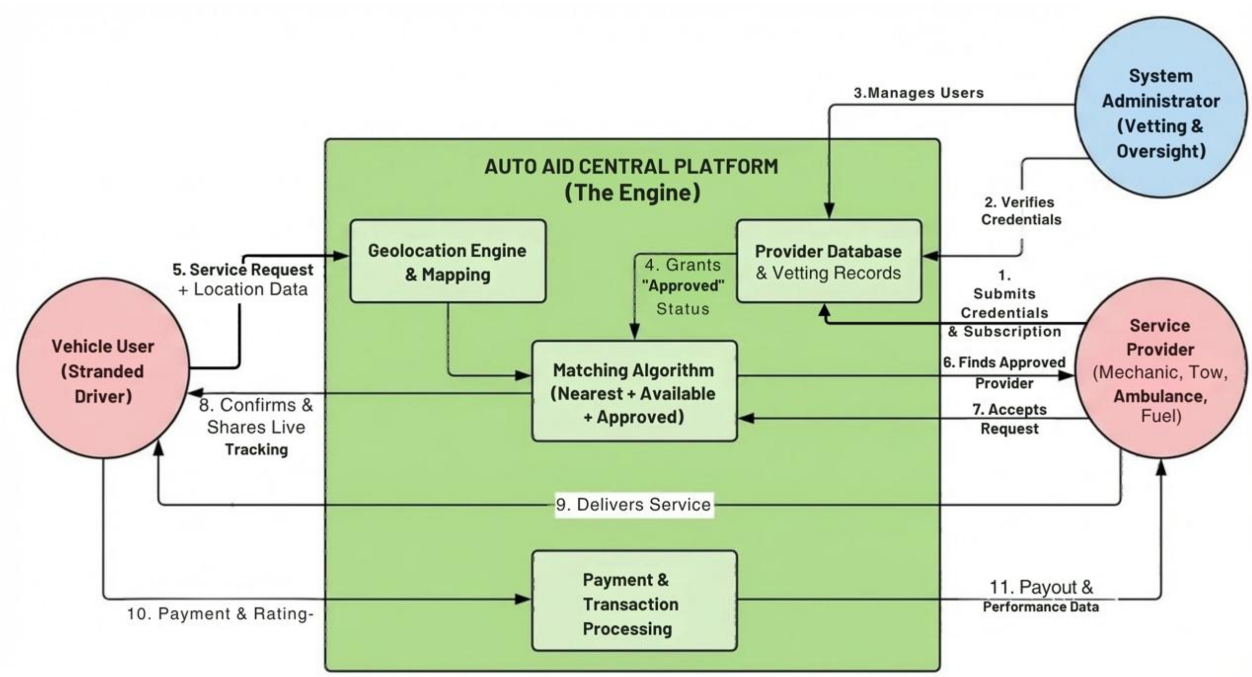
Online Research

Online research was conducted to study existing roadside assistance systems and technologies used in emergency response applications. This helped in identifying technologies that could improve the efficiency of the AutoAid system.

System Design

The AutoAid system was designed to allow drivers to request emergency assistance easily through a mobile application or web platform. When a driver experiences a problem, they can send a request through the system. The system then captures the user’s GPS location and sends it to nearby service providers who can respond quickly.

The flow diagram of Autoaid

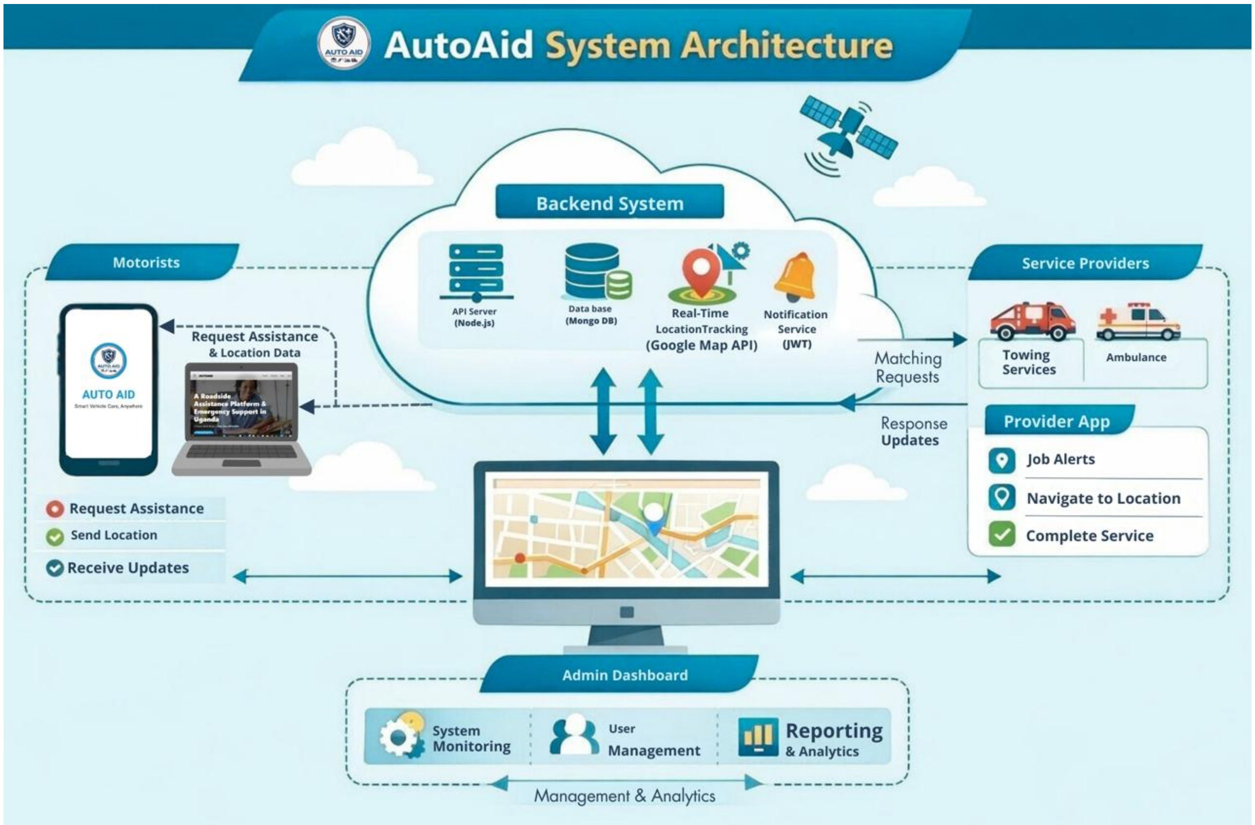


How the system system works:

- User requests assistance
- API receives , validates request and forwards issue to the provider
- System locates nearest provider
- Provider accepts/declines
- System updates user in real time

SYSTEM ARCHITECTURE

The AutoAid system architecture shows how the different components of the system interact to ensure service delivery and follows a **client–server architecture**, where users access services through mobile and web applications while the backend system processes requests and manages data.



The main components of the AutoAid system architecture include the following:

1. **Client Layer (User Interface)**

This is the front-end part of the system where users interact with the AutoAid platform to ensure service delivery.

Motorist Mobile Application:
Allows drivers to request roadside assistance when they experience vehicle breakdowns or emergencies. The application enables motorists to send their GPS location, make service requests and track service updates.

Service Provider Application:
This is used by mechanics, towing operators, Fuel and ambulance service providers. It allows providers to receive service requests, view the motorist's location, navigate to the location using map services and update the system when the service is completed.

Admin Dashboard (Web Interface):
Used by system administrators to monitor system activities, manage users and analyze system performance through reports and analytics.

2. Application Layer (Backend Server)

This layer processes requests and manages communication between the user applications and the database. The backend system is developed using Node.js and handles the core functionality of the AutoAid platform.

Key components include:

API Server:
Handles communication between the mobile applications and the database by processing requests and sending responses.

Request Management Module:
Manages roadside assistance requests from motorists and dispatches them to nearby service providers.

Real-Time Location Module:
Uses GPS location data to identify and connect motorists with the nearest available service providers.

Notification Module:

Uses Firebase Cloud Messaging to send real-time alerts and updates to both motorists and service providers.

Authentication and Security Module:

Ensures secure system access using JWT authentication, password encryption using bcrypt, and role-based access control.

3. Data Layer (Database)

The database layer stores all important information required for the operation of the system. The AutoAid system uses MongoDB to store and manage data.

Examples of stored data include:

- User profiles for motorists and service providers
- Service provider details and availability
- Roadside assistance request records
- Real-time location data
- System activity and service logs
  The database ensures that system data is stored securely and can be accessed efficiently by the backend server.

4. External Services Layer

The AutoAid system integrates with external technologies to enhance its functionality.

Examples include:

Google Maps API:
Used for map display, location tracking, and navigation between motorists and service providers.

GPS Location Services:
Used to capture the real-time location of motorists requesting assistance.

5. **Communication Network**

The AutoAid system relies on **internet connectivity and mobile networks** to allow real-time communication between motorists, service providers, and the backend server.

Through this network, users can send service requests, receive updates, and track service providers in real time.

Tools and Technologies Used

The AutoAid system was developed using modern technologies to ensure efficiency, reliability, and scalability.

Frontend Technologies

The frontend of the system consists of both the Android mobile application and the web interface.

- Android Studio was used as the development environment for building the mobile application.

- Kotlin was used as the programming language for developing the Android application.

- The web interface allows administrators and service providers to manage requests and monitor the system.

These technologies helped create a user-friendly interface for interacting with the system.

Backend Technologies

The backend of the AutoAid system was developed using Node.js. Node.js was chosen because it allows efficient handling of multiple requests and supports real-time communication between users and the system.

The backend server processes assistance requests, communicates with the database, and manages system authentication and responses.

Database

The system uses MongoDB as the database management system. MongoDB stores important information such as:

- User accounts
- Service provider details
- Emergency requests
- Location information

MongoDB was selected because it provides flexibility and efficient handling of large amounts of data.

Location and Mapping Services

Location tracking and mapping were important features in the development of the AutoAid system because they allow service providers to identify the location of drivers who request emergency assistance. Mapping services help visualize the driver's location and enable responders to navigate to the user quickly.

In this project, mapping technologies such as Google Maps API and Leaflet.js were considered for displaying location data and supporting map-based services within the system. These technologies are widely used for integrating maps into web and mobile applications because they provide features such as map visualization, location markers, and route identification.

However, due to financial limitations and the cost associated with using full Google Maps API services, the project implemented a demonstration (demo) version of the mapping functionality during development. The demo was used to simulate how the system would display maps and location information without fully activating the paid API services.

Authentication and Security

To ensure secure communication between users and the system, JSON Web Token (JWT) authentication was implemented.

JWT authentication helps to:

- Verify user identity
- Protect user data
- Secure system access
  This ensures that only authorized users can access the system.

System Development Process

The development of the AutoAid system followed several stages:

1. **Requirement Analysis** – Identifying the features and functions needed in the system.

2. **System Design** – Creating the architecture and interface of the system.

3. **System Development** – Coding the mobile application, web application, and backend server.

4. **Integration** – Connecting the frontend, backend, and database components.

5. **Testing** – Testing the system to ensure that it performs correctly.

System Testing

Testing was conducted to ensure that the system performs correctly and meets user requirements.

Functional Testing

This test verified that the system functions correctly, including sending emergency requests, retrieving user location, and notifying service providers.

Integration Testing

Integration testing ensured that the mobile application, web application, backend server, and database work together properly.

User Testing

User testing was conducted to determine whether the system is easy to use and effective during emergency situations.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

This chapter presents the results obtained from the design and development of the AutoAid system. It explains the system technology, specifications, requirements, implementation process, and testing results.

The purpose of this chapter is to show how the developed system works and how it addresses the problem of delayed roadside assistance.

Description of the Designed Technology

The AutoAid system is a digital platform designed to help drivers receive assistance quickly when they experience vehicle breakdowns or roadside emergencies.

The system consists of two main platforms:

- Android Mobile Application – Used by drivers to request help.
- Web Application – Used by administrators and service providers to manage requests and monitor the system.

When a driver sends a request through the mobile application, the system captures the driver’s GPS location and sends the information to the backend server.

The server processes the request and notifies nearby service providers who can respond quickly.

This technology improves response time and helps drivers receive assistance faster compared to traditional roadside assistance methods.

System Specifications

The AutoAid system was developed using several modern technologies. The main specifications of the system include:

- Android mobile application developed using Android Studio and Kotlin.
- Backend server developed using Node.js.
- Database system using MongoDB.
- Mapping services using Google Maps API and Leaflet.js.
- GPS-based location tracking for identifying the user’s position.
- Secure authentication using JSON Web Token (JWT).

These technologies allow the system to function efficiently and securely while supporting both web and mobile platforms.

System Requirements

Hardware Requirements

The system requires the following hardware components:

- Smartphone with GPS capability.
- Computer or laptop for system administration.
- Internet connection.
- Server environment for running backend services.

Software Requirements

The system requires the following software components:

- Android operating system for running the mobile application.
- Web browser for accessing the web platform.
- Node.js runtime environment.
- MongoDB database management system.
- Google Maps API and Leaflet.js for location and map services.

These requirements ensure that the AutoAid system operates effectively across different devices.

System Implementation

The implementation of the AutoAid system involved developing both the Android application and the web application, and connecting them to the backend server.

The implementation process included the following steps:

- Developing the Android mobile application using Kotlin in Android Studio.
- Creating backend APIs using Node.js.
- Designing and implementing the database using MongoDB.
- Integrating Google Maps API and Leaflet.js for map display and location services.
- Implementing JWT authentication to secure user login and system access.
- Integrating GPS services to capture the user's real-time location.

After development, all system components were integrated and tested to ensure smooth communication between the mobile application, web platform, backend server, and database

System Testing

System testing was carried out to evaluate whether the system performs its intended functions correctly.

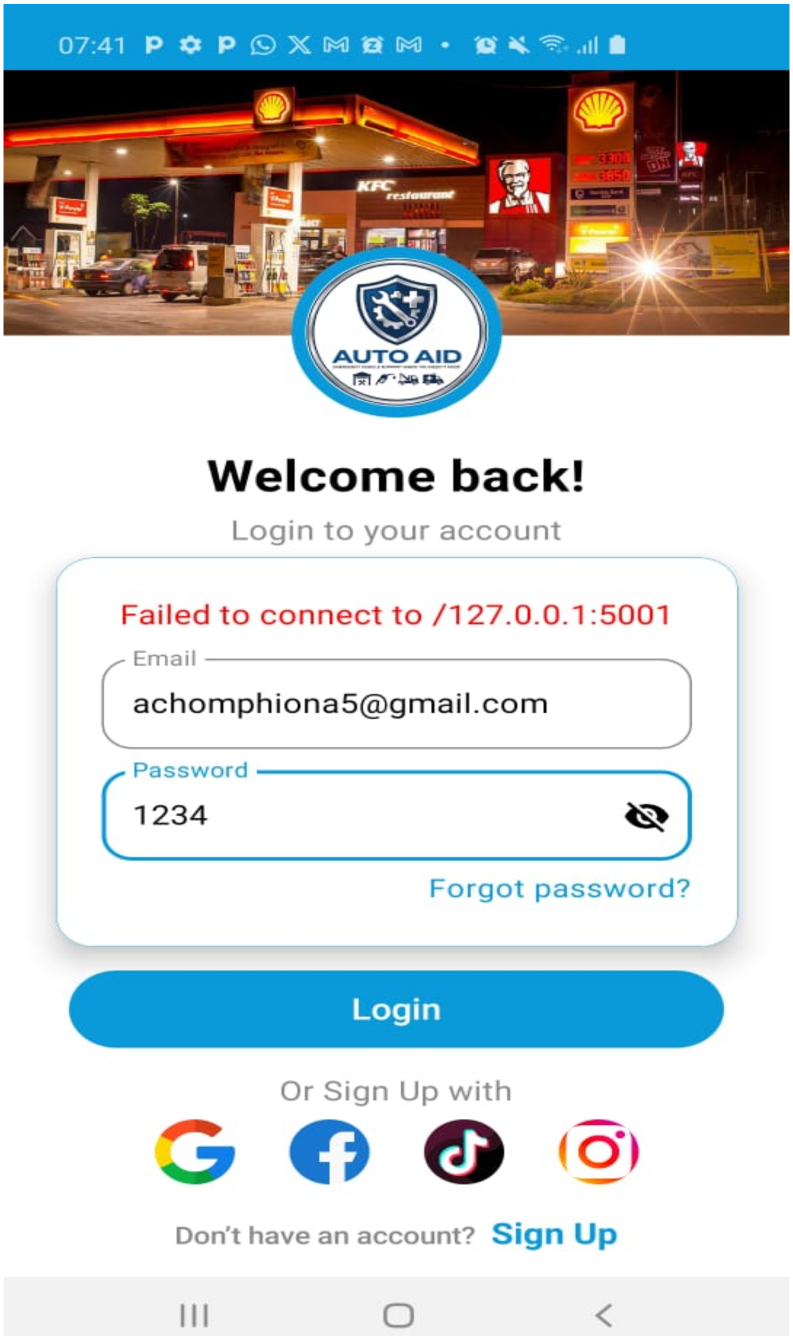
The results showed that the system successfully:

- Allows drivers to send emergency assistance requests through the mobile application.
- Captures and transmits the user's GPS location.
- Displays location information using map services.
- Notifies service providers through the web platform.
- Secures user authentication using JWT tokens.

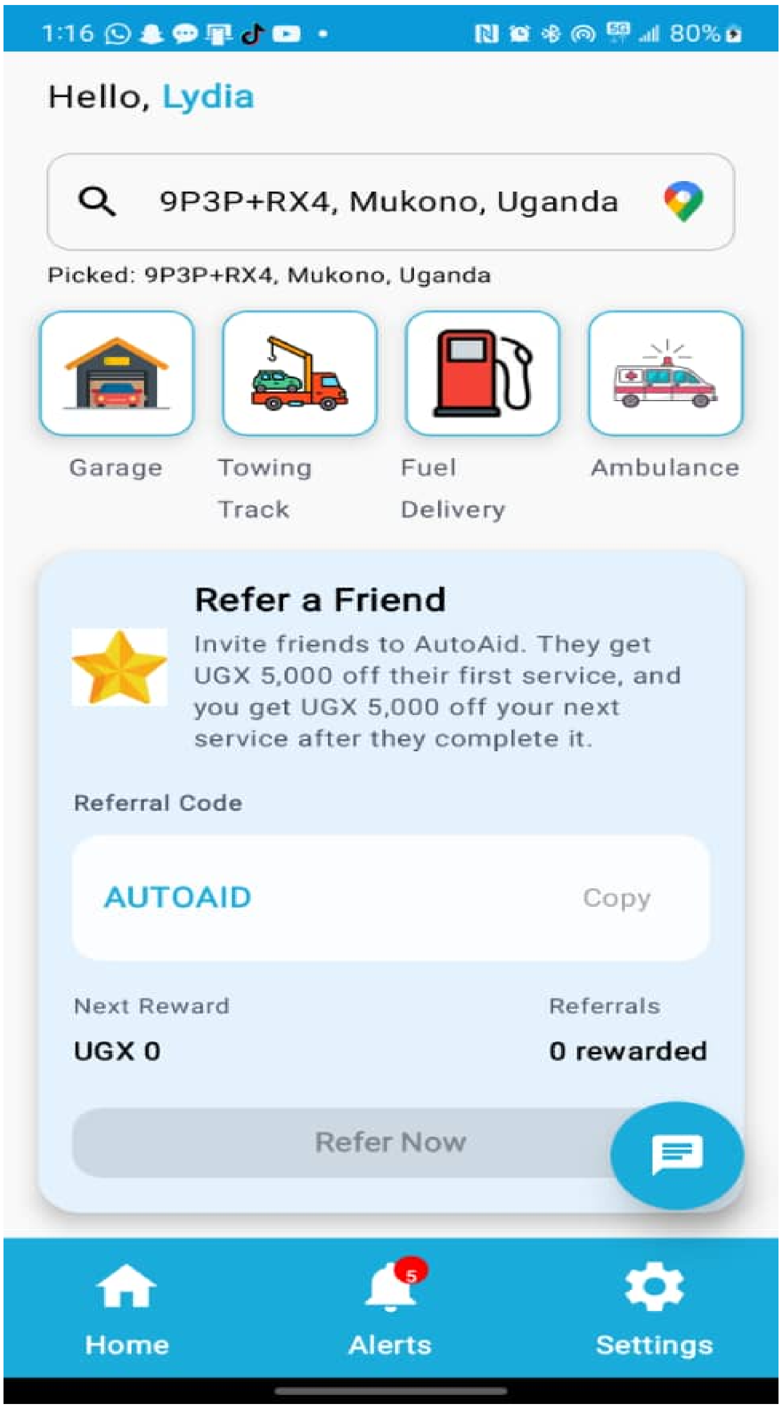
These tests confirmed that the system works as expected and can support emergency assistance services.

RESULTS

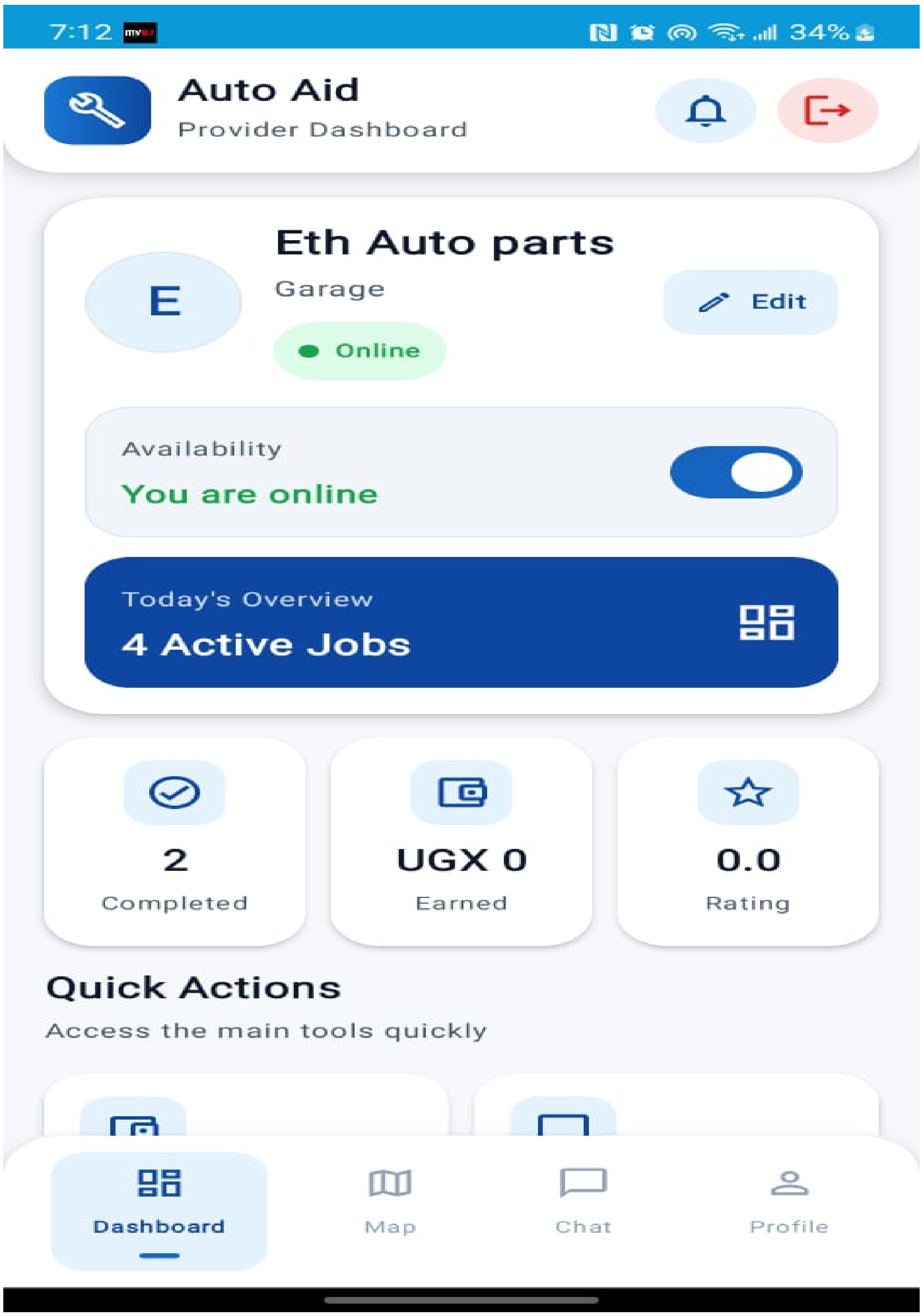
LOGIN SCREEN



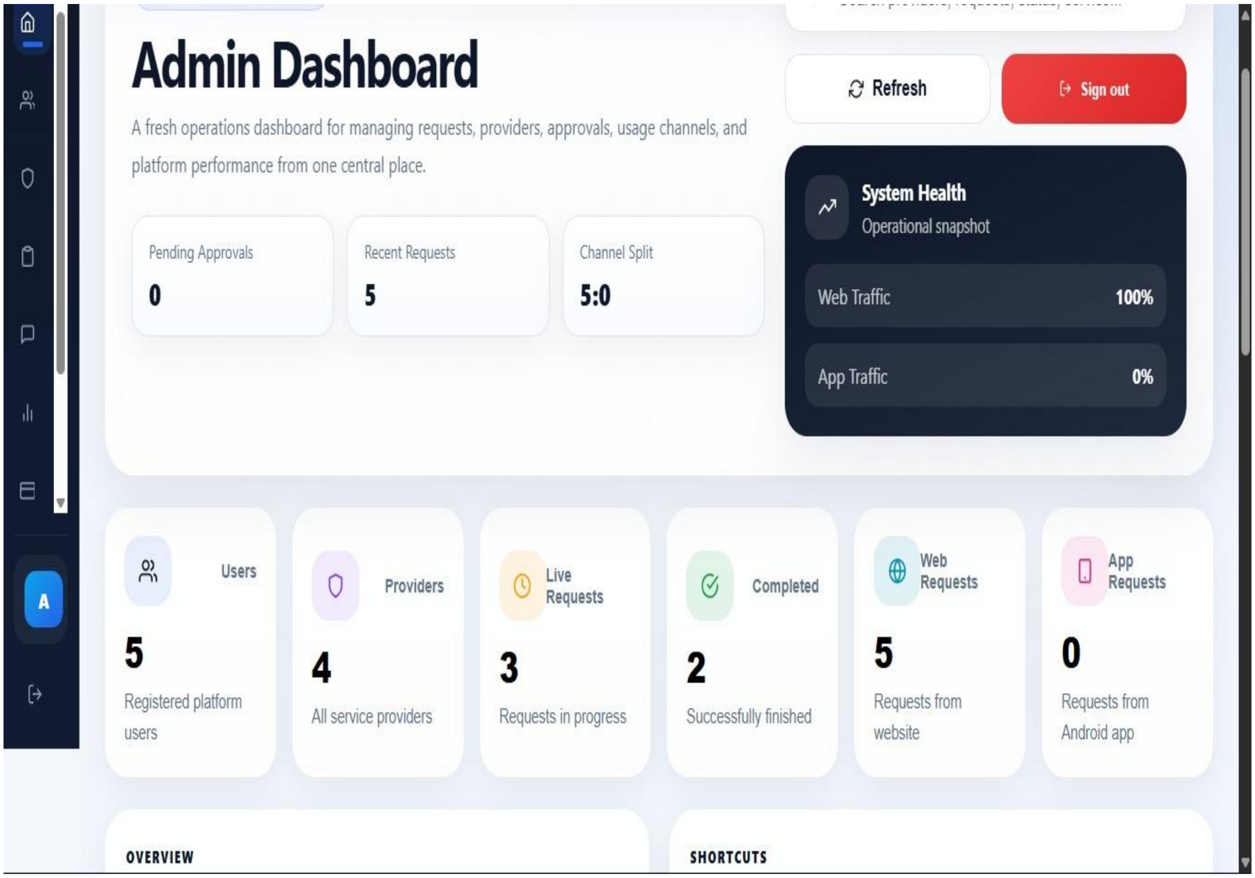
DRIVER/ RIDDER/ VICTIMS DASHBOARD



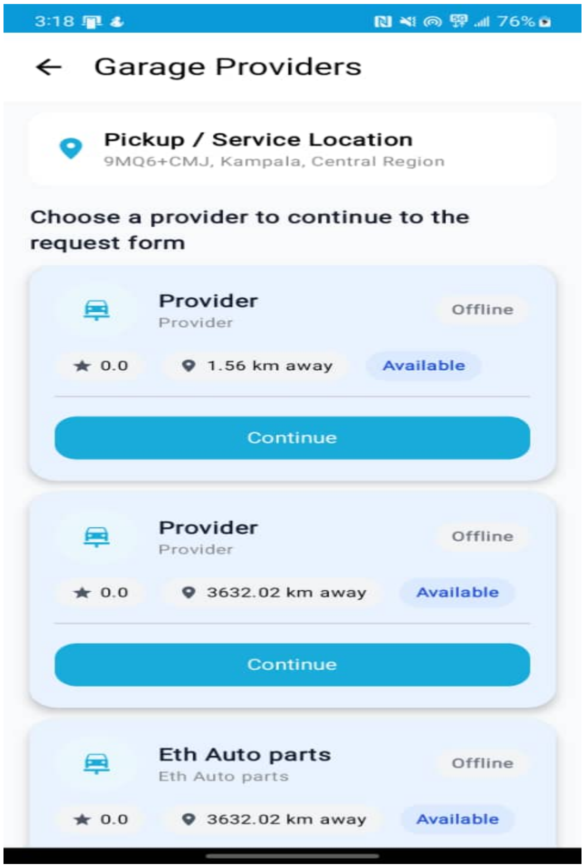
SERVICE PROVIDER DASHBOARD (GARAGE)



ADMINSTRATOR DASHBOARD



CAPTURED SURVICE PROVIDERS SOFAR



Discussion of Results

The results demonstrate that the AutoAid system provides an effective solution for improving roadside assistance services.

By using GPS-based location tracking, service providers can locate drivers quickly and respond faster during emergencies.

The integration of both mobile and web platforms allows different users to interact with the system according to their roles.

Drivers can easily request help through the mobile application while service providers and administrators can manage requests through the web platform.

However, the performance of the system depends on internet connectivity and GPS availability. In areas with weak network coverage, system performance may be affected.

REFERENCES.

Admin, & Admin. (2025, June 23). Handling car breakdowns and roadside assistance in Uganda. *Supreme Car Rental Uganda - Rent A Car In Uganda*. https://www.supremecarrentaluganda.com/car-tips-news/handling-car-breakdowns-and-roadside-assistance-in-uganda.html?utm_source

Kazibwe, Kenneth. "Uganda's Emergency Medical Services Still Wanting- New Survey." *Nilepost News*, 28 Nov. 2024, nilepost.co.ug/news/229786/ugandas-emergency-medical-services-still-wanting-new-survey. Accessed 5 Mar. 2026.

Economic Policy Research Centre. (2023). *The economic cost of road accidents in Uganda*. Kampala: EPRC.

https://eprcug.org/publications/the-economic-cost-of-road-accidents-in-uganda

Kiggundu, N. (2022). *Challenges in Uganda's emergency medical response systems*. *African Journal of Emergency Medicine, 12*(3), 145-152.

https://doi.org/10.1016/j.afjem.2022.05.004

Ministry of Works and Transport. (2023). *Annual road safety performance report*. Kampala: Government of Uganda.

https://www.works.go.ug/library/annual-road-safety-report-2023

Ministry of Works and Transport. (2024). *National transport policy update: Vehicle ownership trends*. Kampala: Government of Uganda.

Nkurunziza, A., et al. (2023). *Digital solutions for roadside assistance in East Africa*. *Journal of Transport & Health, 28*, 101-112.

https://doi.org/10.1016/j.jth.2023.101112

Uganda Police. (2024). *Annual crime and traffic report 2023*. Kampala: Uganda Police Force.

https://www.upf.go.ug/wp-content/uploads/2024/06/Annual-Crime-Report-2023.pdf

Uganda Police. (2025). *Annual crime and traffic report 2024*. Kampala: Uganda Police Force.

https://www.upf.go.ug/wp-content/uploads/2025/05/Annual-Crime-Traffic-Report-2024.pdf

Uganda Red Cross Society. (2024). *Road accident response gaps in Uganda*. Kampala: URCS.

https://www.redcrossug.org/reports/road-accident-response-2024

World Health Organization. (2023). *Global status report on road safety 2023*. Geneva: WHO.

https://www.who.int/publications/i/item/9789240086517

News: UCU lecturer crashed by cement truck at Nkumba. (2024, April 17). New Vision. https://www.newvision.co.ug/category/news/ucu-lecturer-crashed-by-cement-truck-at-nkumb-NV_186111_032026

RAC. (n.d.). *RAC | Breakdown Cover & Car Insurance | Route Planner*. https://www.rac.co.uk/

News Report. (2021, April 22). *AAA's Travel, Navigation, Road service now available via select GPS-Enabled cell phones*. GovTech. https://www.govtech.com/dc/articles/aaas-travel-navigation-road-service-now.htm

lSmith, J., & Jones, R. (2020). *Global trends in digital roadside assistance services: A comparative analysis*. International Journal of Transportation Systems, 12(3), 45–61.