GIS-OPTIMISED BIN LOCATIONS ON KNUST CAMPUS

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AfricaGIS 2025

UN-GGIM: AFRICA
UNITED NATIONS
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT

AfricaGIS 2025 and UN-GGIM: Africa XI Joint Conference

Harnessing Geospatial Intelligence for Africa's Sustainable and Resilient Future

17-21 November 2025, Alisa Hotel, Accra, Ghana

United Nations Economic Commission for Africa

EIS

FIG International Federation of Surveyors
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Presentation Outline

- Background Information
- Research Aim and Objectives
- Study Area
- Project Methodology
- Results and Discussion
- Conclusions
- Recommendations

Background Information 1/2

1. Managing solid waste on university campuses is a complex and vital component of sustainability initiatives.

2. Universities like, mini-cities, face increasing waste challenges due to the growing student and staff populations.

3. By leveraging GIS, we can strategically optimize the placement of waste bins to ensure proper coverage and accessibility.

Background Information 2/2

Problem Statement

- Current waste management practices rely on traditional methods that lack real-time data monitoring, predictive analytics, and optimization techniques.
- A key limitation of the existing system is the lack of a GIS-enabled waste tracking, sensor-based monitoring, and route optimization.
- The absence of spatial intelligence in bin allocation and collection operations leads to inefficient resource utilization, and a higher fuel consumption.

Research Aim and Objectives

The research aims to enhance waste management practices on the KNUST campus using GIS.

Specific Objectives (SO)	Questions	Approaches
1. To determine existing bin location and collection routes.	1. How are the existing bin locations and collection routes currently distributed on campus?	1. Data Collection of existing bins 2. Review of existing routes 3. Data Integration
2. To suggest optimal collection routes and bin locations.	1. How can a GIS-based approach be utilized to optimize bin locations and collection routes to enhance waste management?	1. Spatial Analysis 2. Optimization of bin locations 3. Route Optimization 4. Performance Analysis

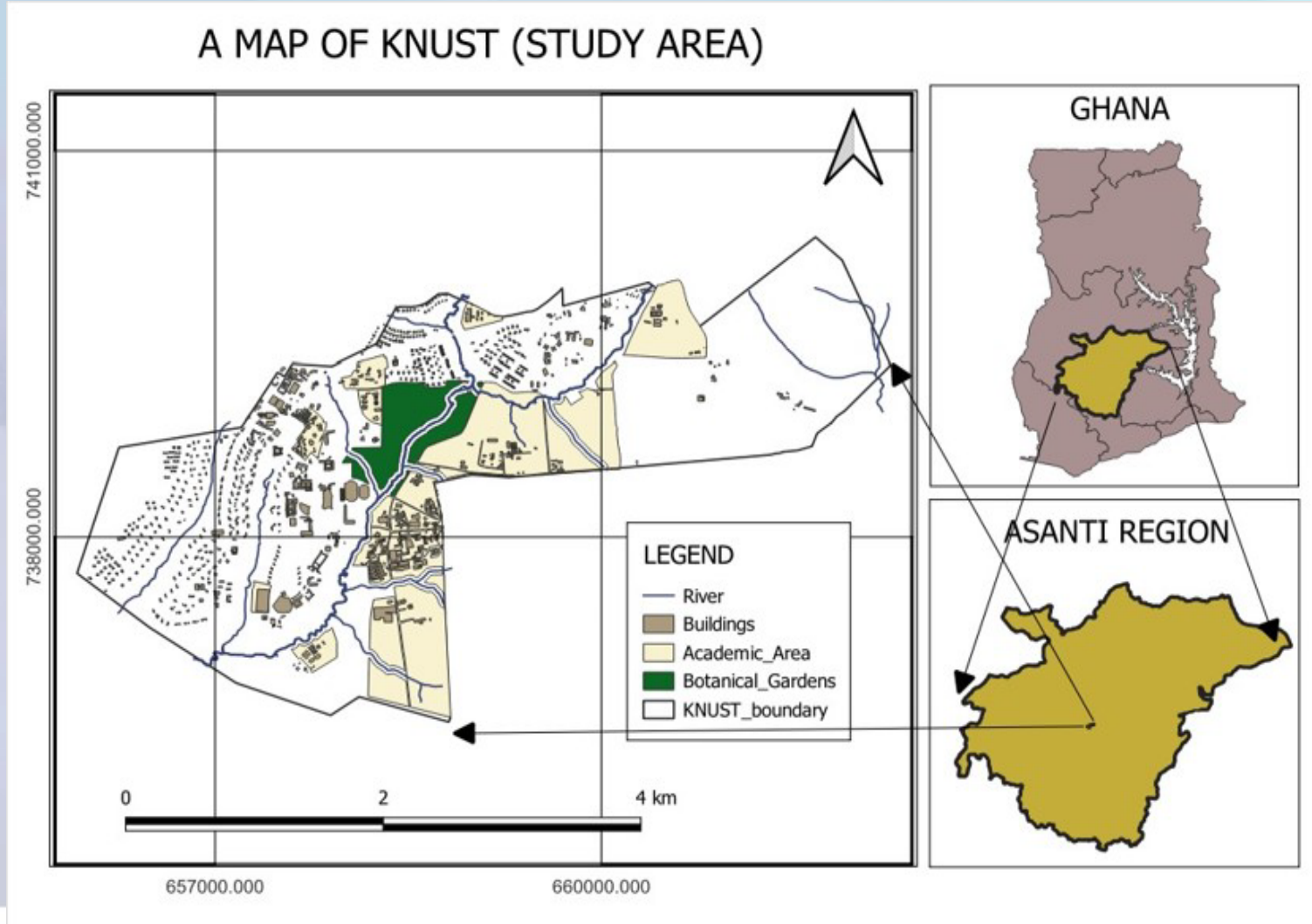
Study Area

- Located in the Oforikrom Municipality, Ashanti Region, Ghana
- Covers approximately 18 km^2 in an urban setting
- Bordered by Ayigya, Bomso, Ayeduase, Kotei, and Gyenyaase
- Functions like a **micro-city** with diverse land uses
- Divided into **three main zones**:

  Faculty area – Six colleges

  Residential area – Student hostels & staff housing

  Commercial area – Shops and activity centers



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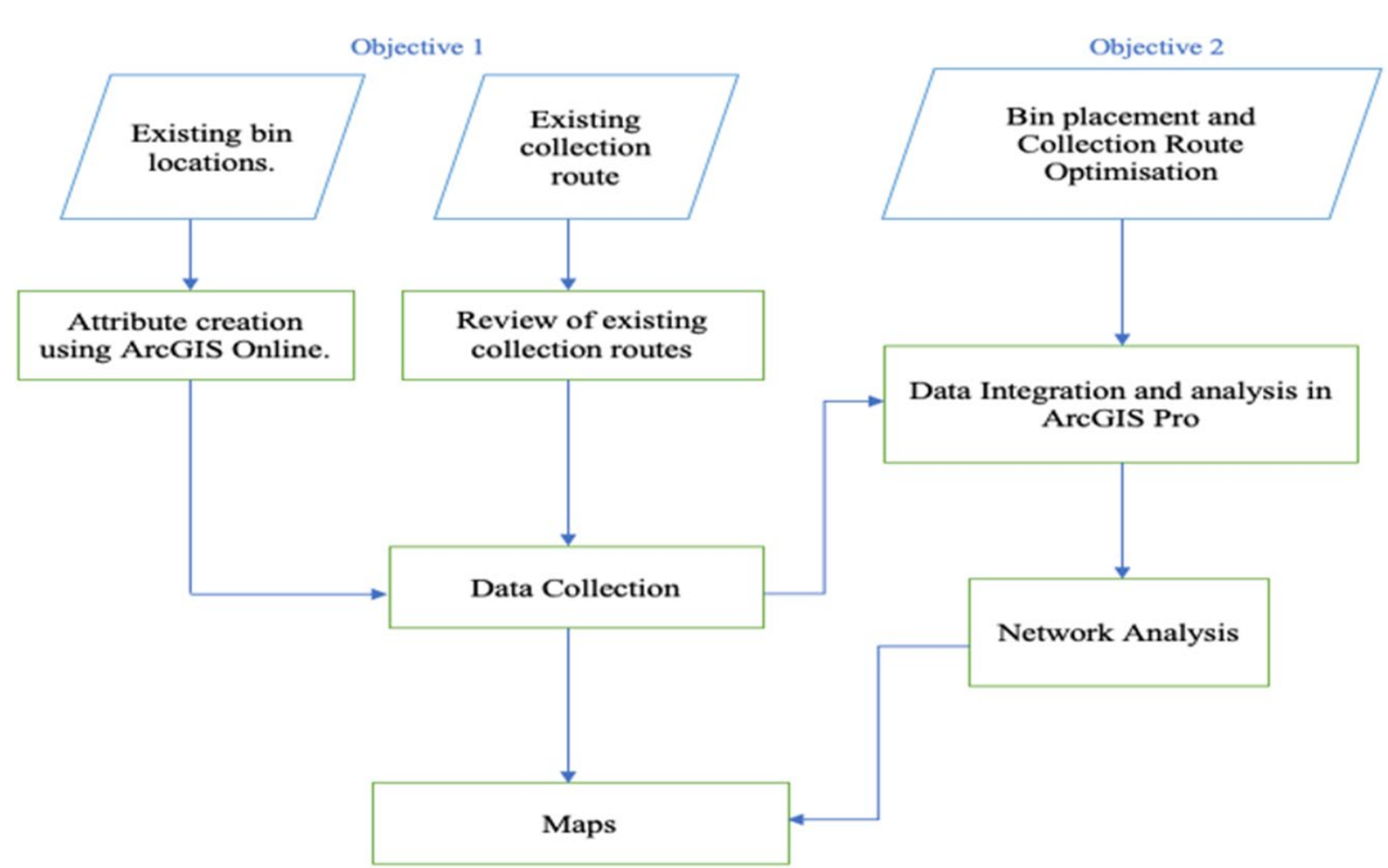
Project Methodology



GIS APPLICATIONS USED:

- ArcGIS Online
- ESRI's field map mobile app
- ArcGIS Pro

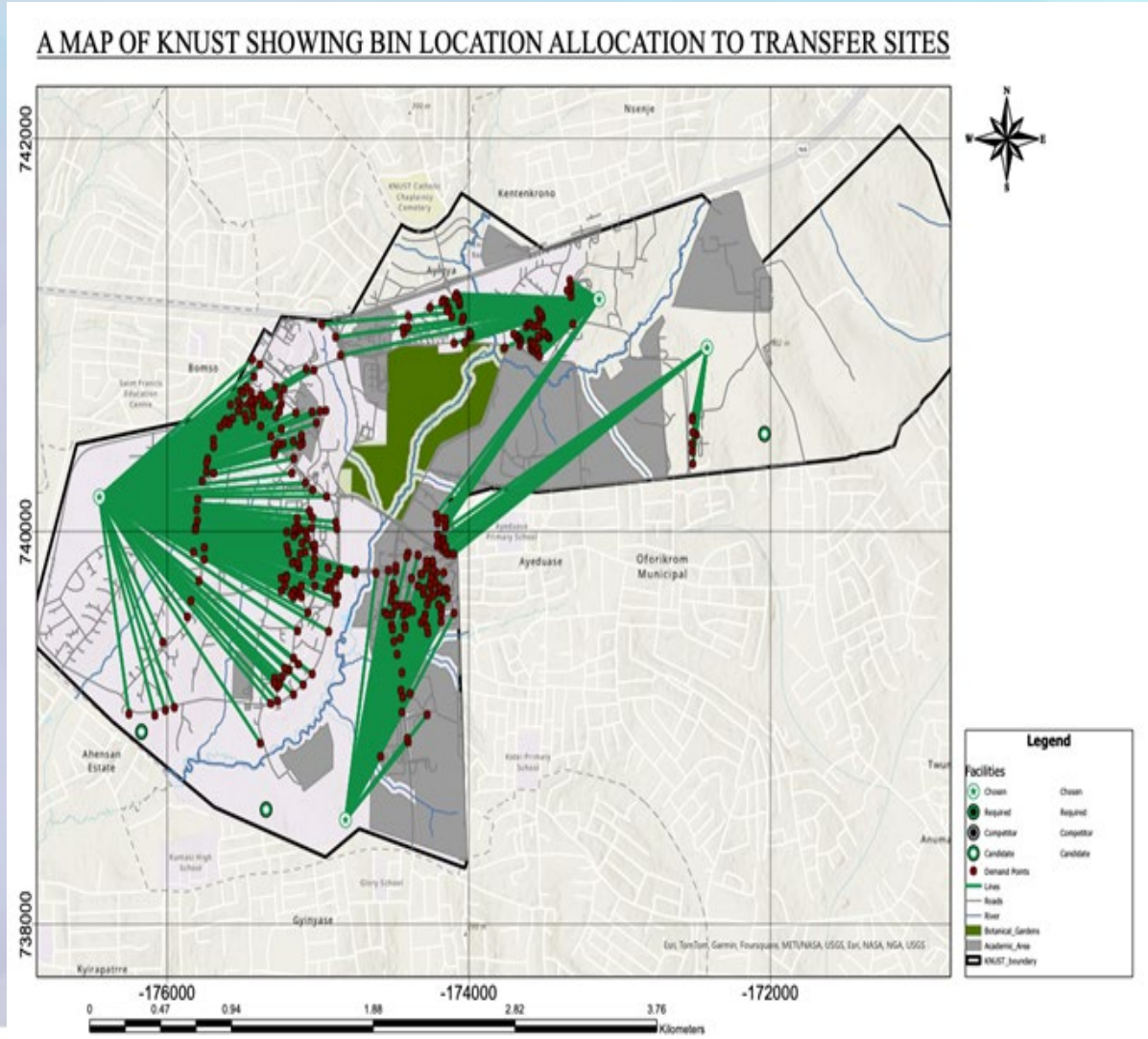
Results and Discussion 1/2

Bin Optimization

- ✓Conscious efforts has been made to evenly distribute bins on campus.
- ✓However, the analysis reveals notable gaps in coverage.
- ✓Transfer stations selected based on road access and environmental safety.

Route Optimization

- ✓ Current routes rely on drivers' judgment.
- ✓Optimized route reduction in distance from 13.02km to 12.1km.



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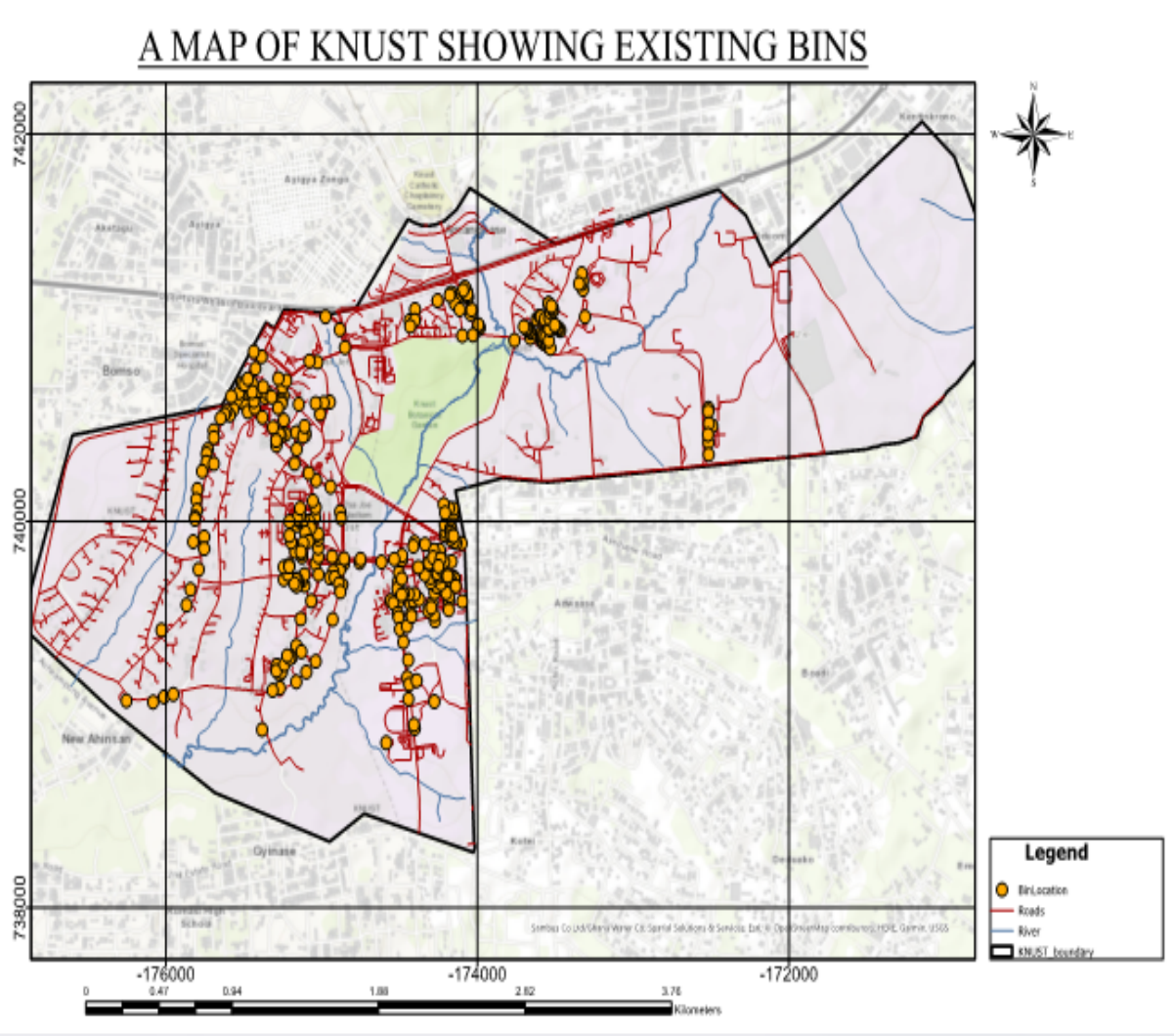
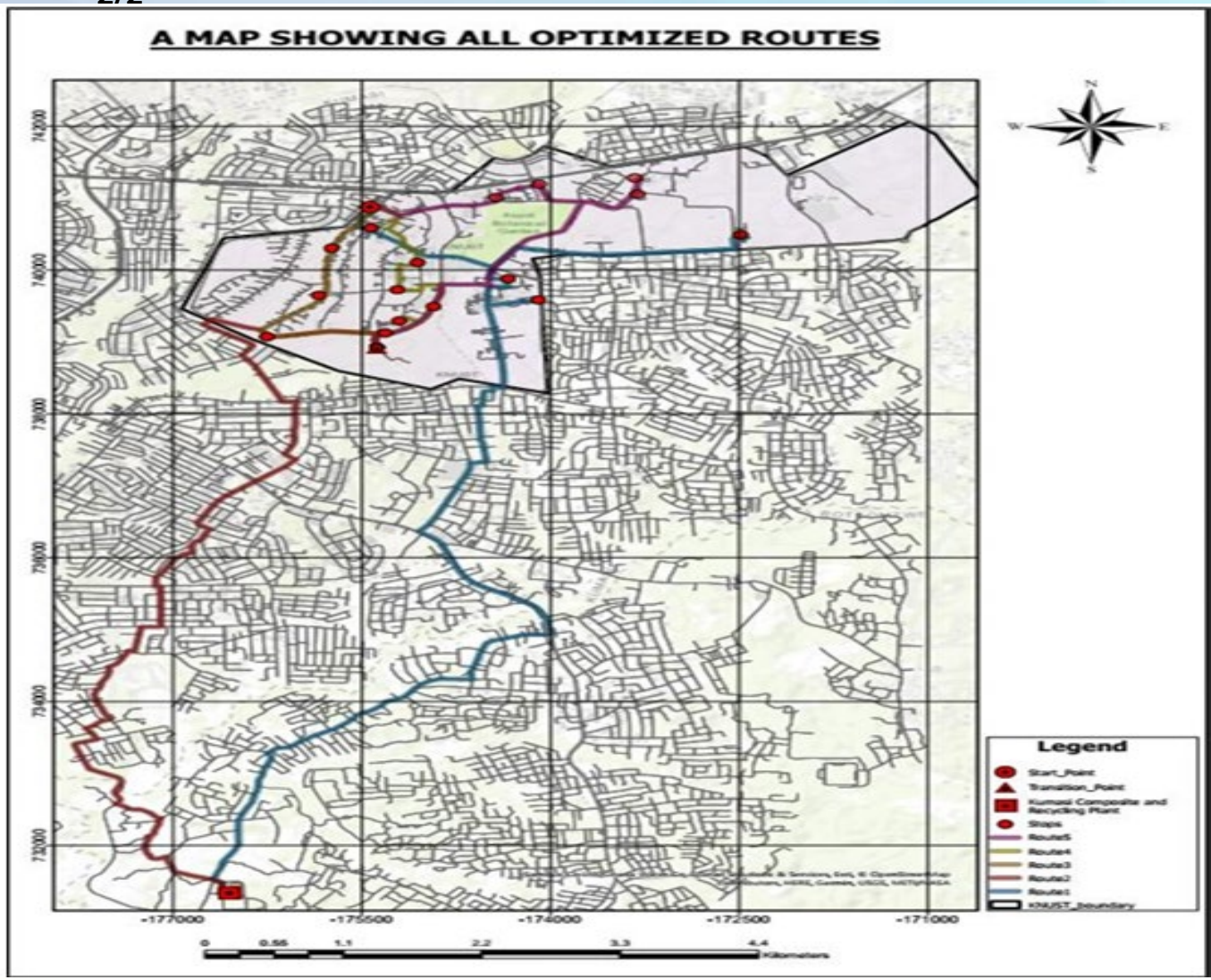
Results and Discussion 2/2





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Conclusion

1

SMART WASTE MANAGEMENT

GIS-optimized bin placement improves cleanliness and service delivery through data driven planning.

2

ENABLING SMARTER URBAN SYSTEMS

Real-time monitoring and spatial intelligence (example; Use of dashboards) strengthen efficiency and support smart city operations.

3

SCALABLE IMPACT FOR AFRICAN CITIES

This research offers a scalable, low-cost framework that can guide smarter waste management planning in African cities.

Recommendations

1

PILOT THE FRAMEWORK IN URBAN COMMUNITIES

Stakeholders can test this approach in selected communities to assess practicality and user response

2

ASSESS SMART CITY INTEGRATION

Analyze how this research can support scalable waste management planning within African smart city initiatives.

THANK YOU!

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