



International Road Federation
Fédération Routière Internationale
Federación Internacional de Carreteras



2022 SARF • IRF • PIARC

7TH REGIONAL CONFERENCE FOR AFRICA
& PIARC INTERNATIONAL SEMINAR ON RURAL ROADS AND ROAD SAFETY

CONNECTING AFRICA THROUGH SMART, SAFE AND RESILIENT ROADS

18 - 20 OCTOBER 2022 | Cape Town International Convention Centre

BIG DATA AND GEOSPATIAL ANALYSIS FOR IMPROVED CROSS-BORDER ROAD PASSENGER TRANSPORT BETWEEN SOUTH AFRICA, BOTSWANA, ESWATINI AND MOZAMBIQUE

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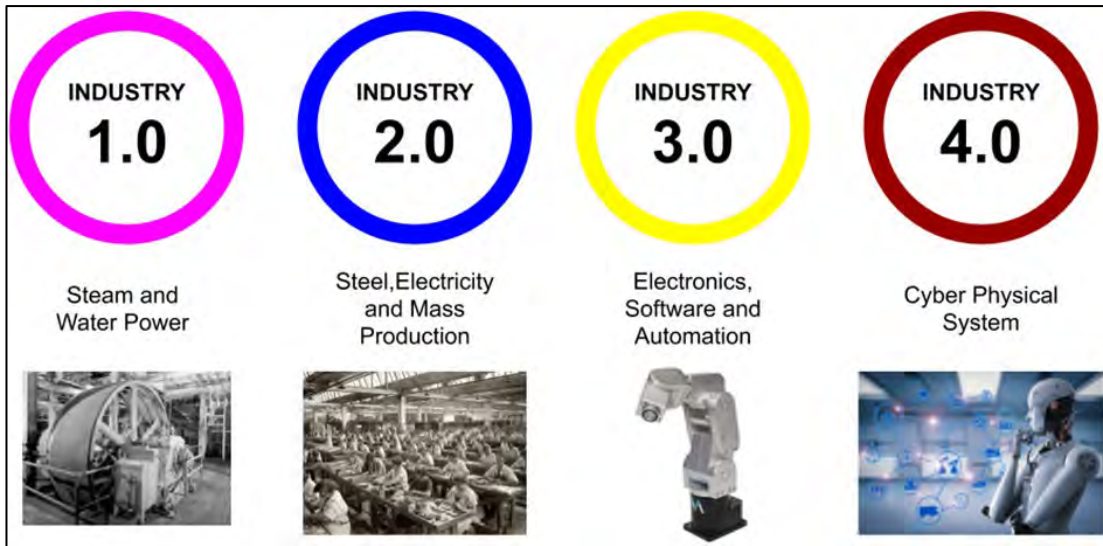
19 October 2022

Context

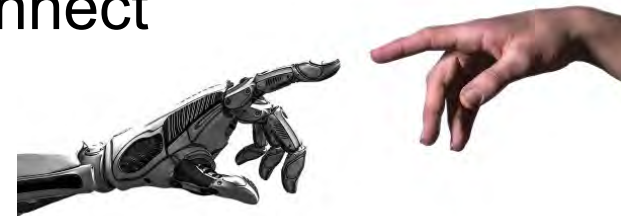
- 1 Introduction and Background
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1. Introduction

Big data and fourth industrial revolution (4IR) have propagated advances in artificial intelligence and has largely been applied to the transportation system.



Machines and people connect



2. Introduction

Parallel to the availability of Big Data to model the movement of people, Geographical Information Systems (GIS) is paramount to adopting new innovative ways of improving transport systems.



3. Introduction

- Africa has the opportunity to tap into the 4IR with the robust application of GIS in improving transportation systems.
- Minibus taxis (MBTs) are a commonly used mode of the road transport system in Africa on a day-to-day basis and can be tracked in real-time from point of origin to destination.



4. Background

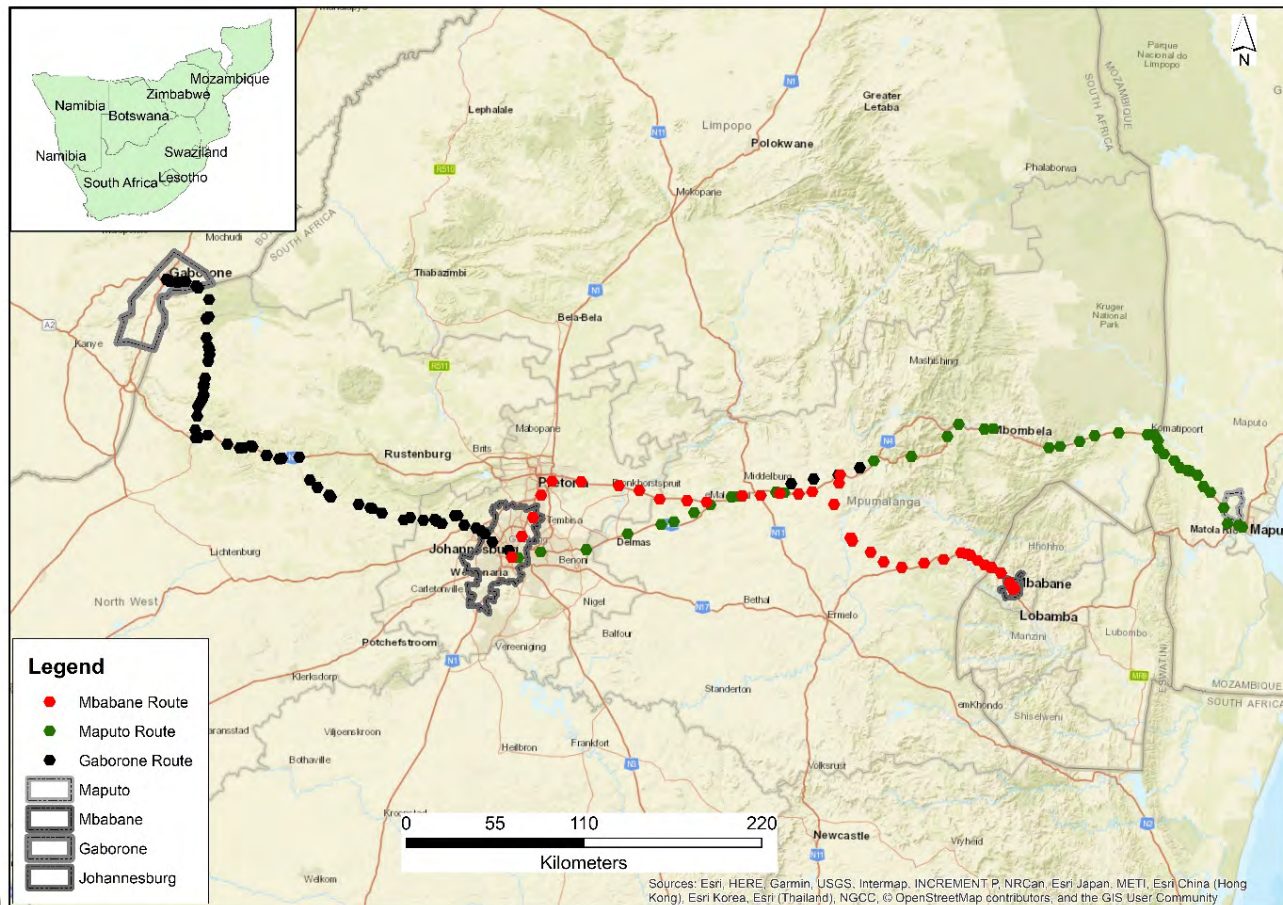
- Due to the opportunities afforded by internet of things (IoT) & 4IR, it is possible to extract raw Global Positioning System (GPS) data with movement patterns, timestamps, and speeds.

Study Aim

- This study mapped movement patterns of cross border minibus taxis (MBTs) between, South Africa, Botswana, eSwatini, and Mozambique during different periods i.e., peak and off-peak from origin to destination.

5. Methodology

The study focused on three different routes; Johannesburg-Maputo; Johannesburg-Mbabane; Johannesburg-Gaborone.

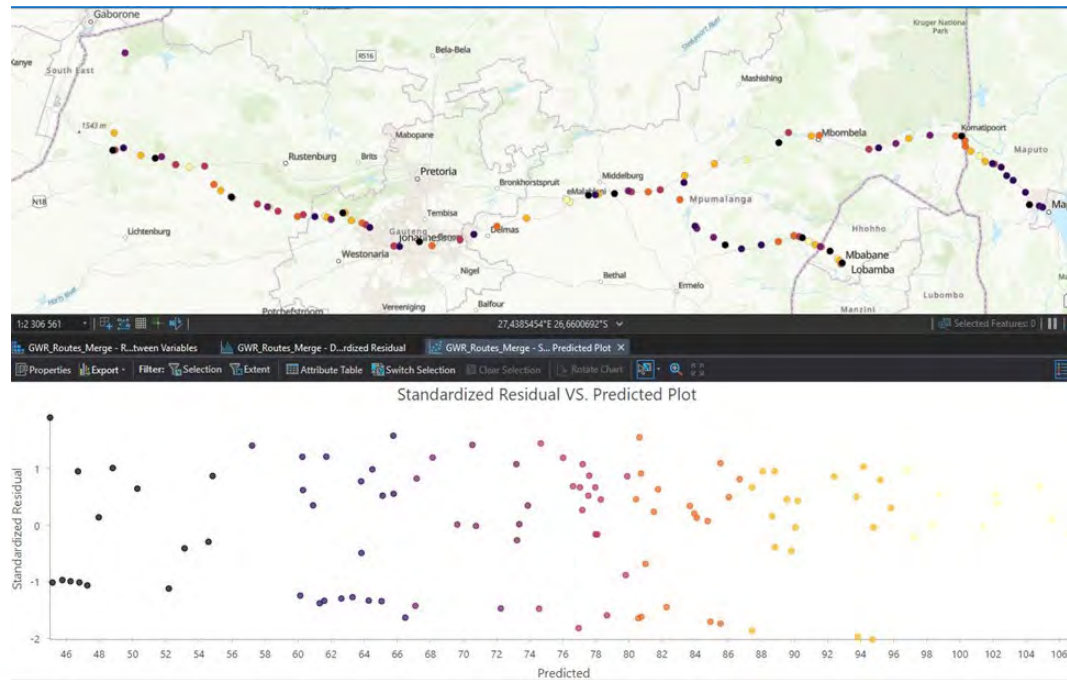


6. Methodology

- Data collection was conducted using advanced Garmin series Global Position System (GPS) tracking technology mounted on the cross border MBTs.
- The GPS receivers measure positions through their array of navigational satellite data transmitted by satellite and they receive the satellite signals and compute the receiver position and velocity.
- In theory, GPS tracked the MBT movements and detected events on the MBT trajectory which exhibit movement patterns such as the speed, and motionless and moving pattern of the MBT.

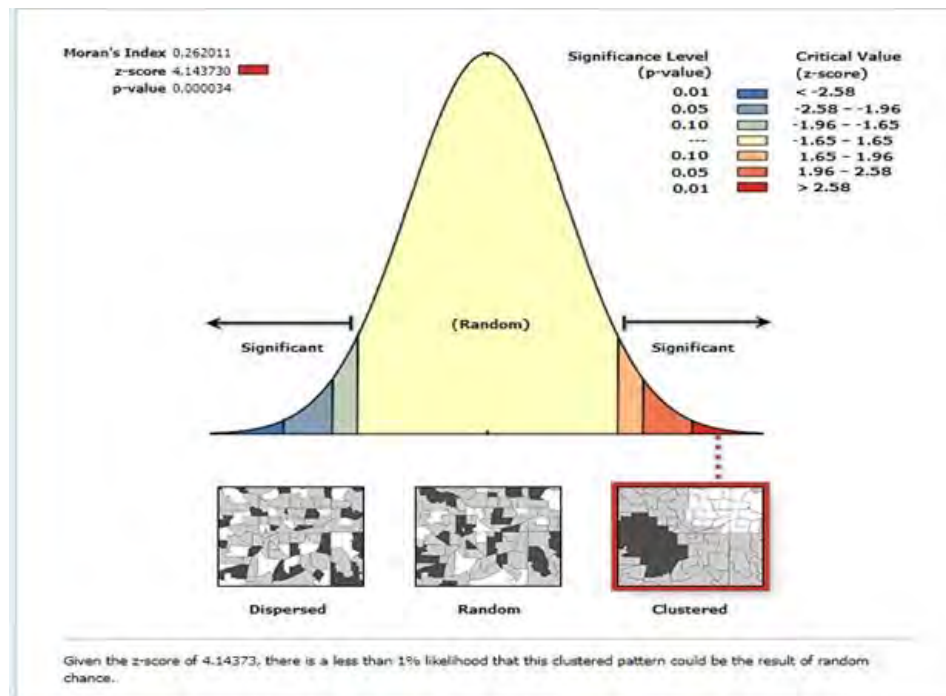
7. Results

The outcomes of Geographical Weighted Regression (GWR) on different routes showed that the R^2 ranged between 0.134 – 0.147 which represents a weak relationship between the different routes and travel patterns. Movement behaviours of the MBTs on the analysed routes showed no correlation.



8. Results

Moran's I spatial autocorrelation showed high significance (p-value <0.000034) values, and high clustering of high speed when the MBT are away from the cities. The presence of systematic positive spatial autocorrelation, with areas or sites that are close together, have similar values.



9. Conclusion

- To improve the interrelation between public passenger transport and sharing economy transportation modes, the MBT and the transport authorities should aim at introducing big data mining.
- GPS and GIS technologies will improve the collection, management, and reporting of cross-border road passenger transport data. It is therefore imperative to develop data management hubs that improve the quality of cross-border road passengers and MBT operators.
- It is critical to fully deploy 4IR technologies to improve cross-border road passenger transport system in developing nations coupled with investment and integration from different stakeholders. This will aid in the understanding of the different corridors during peak and off-peak periods.



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THANK YOU

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