reviewed paper

Examining the Applicability of Location Based Services to Determine the Movement Patterns of Commuters between Sandton and Park Station in Johannesburg City

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1 ABSTRACT

The movement of people within cities forms patterns and changes the development of transport systems as well as innovations within the Information and Communication Technologies (ICT) sector. The City of Johannesburg has been witnessing massive transformations in urban public transport systems in the past decade and very little is currently known about the movement patterns of commuters between major centres of the city. Investigating and illuminating novel insights on the movement patterns of commuters is very imperative and essential given the multiplicity of modes and centres in increasing decentralized cities such as the Johannesburg Metropolitan City. This work therefore examine the applicability of location based services to determine the movement patterns of Gautrain and Rea Vaya commuters between Sandton and Park station centres, using a case study research design and mixed methods approaches consisting of qualitative, quantitative and spatial data. This research presents novel data analysed into empirical results suggesting that location based services plays a pivotal influence in determining movement of urban public transport commuters in Johannesburg city. The findings also reveal the complexity of spatial and communicative platforms in multiplicity of urban public modes resulting in complex models of movement patterns. These empirical results require further research on the applicability of location based services in determining movement patterns of commuters, with the aim of corroborating the prospects of agglomerating an urban mobility model at a city wide scale.

Keywords: micro city centres, movement patterns, Johannesburg metropoitan city, urban public transport, South Africa

2 INTRODUCTION

Urban public transport is one of the most important factors for the functionality of any city. It is a socio-economic need pivotal for humans' every day sustenance. Furthermore, urban public transport systems have evolved over the years from being just mere transportation to vehicles that improve people's lives through Transit Oriented Development (TOD). Moreover, the focus on providing sustainable transport is at the fore front of development currently consisting of multiplicity of modes that ensure integration. Beyond the provision of urban public transport as a socio-economic necessity lies the interest to investigate urban public transport commuter mobility patterns. It is identified that human mobility patterns in urban public transport have been researched, focusing on but not limited to health aspects, human needs and geo-simulation of urban mobility. Some studies include past and present travel patterns in cities while others focus on transportation analyses in general (Zia et al., 2013; Fang et al., 2012; Gao et al., 2013; Li et al., 2011).

Movement of people within a city changes with time as a result of developing transportation systems in addition to innovations within the Information and Communication Technologies (ICT) sector (Mitchell and Casalegno, 2005). Cities across the world have come of age and are moving towards the smart city concept inclusive of the smart mobility component. According to Siemens (2015), smart mobility "is a paradigm shift to a more flexible and multi-modal transport system that allows seamless, efficient and flexible travel across various modes", as a way of addressing transportation challenges such as traffic congestion, green-house emissions, longer commuting and many more. Although some countries have championed this concept through innovative Intelligent Transport Systems (ITS), in others it is still a new concept that needs to be adopted as a way of redressing urban public transport challenges, particularly connectivity among different micro city centres (Cardinale et al., 2014; Chen et al., 2014; City of Johannesburg, 2009; Deloitte, 2014; Dreskovic & Nurkovic, 2014; Ferris et al., 2010; Franz et al., 2014).

While identifying key issues to address in this endeavour, it is important to understand movement patterns of commuters between different micro city centres (Allbach et al., 2014; Ambrosino et al., 2014; Amegui, 2014; Bajracharya et al., 2014; Bululukova et al., 2014). Decentralized major cities brewing locations with

high level concentration of economic activities and complex spatial structures supported by urban public transport systems are becoming more complex as more micro city centres emerge (Seimens, 2015). Therefore there is need to understand how commuters move between these micro city centres. Getting to know how spaces are connected between micro city centres can inform planning and provision of adequate and responsive public transport systems.

Generally, movement in the Johannesburg Metropolitan City has been an overarching issue for many years, owing its faults to the historic spatial fragmentation and rapid urban population growth (City of Johannesburg, 2013). Over the years, studies have focused more on how urban planning has sought to redress the implications of spatial structure in some instances lacking to fully understanding the needs of commuters. Consequently, efforts by government (local, provincial, national) in the city have not fully aided the situation. They have rather battled to make urban public transport systems accessible, affordable and safer for commuters. Although the main concern has been central to integration of urban public transport systems in the city, there is vast need in focusing on movement patterns of commuters using urban public transport as a mission for improvement (Wilkinson, 2009; Williams, 2011).

Urban public transportation is at the heart of the Johannesburg Metropolitan City's development agenda. The city has been making efforts to create Transit Oriented Development (TOD) and urban renewal as a way of building 'corridors of freedom' (Gauteng Department of Roads and Transport, 2013; Steer, 2012; Transportation Research Board, 2009). There have been massive innovative urban public transport systems developments in the City of Johannesburg since 2010 that among others include the Gautrain and Rea Vaya bus services as a way of improving the already existing Metrobus, Taxis and Metro rail services (The Gautrain Management Agency, 2013; City of Johannesburg, 2013; Gauteng Department of Roads and Transport, 2013).

Of late, Sandton and Park station have been receiving massive flow of movement; this is evident through the daily amounts of traffic between the two centres often causing traffic congestions. Moreover, there has also been an introduction of other modes and how they move people between these two centres has become a focus (Rudd, 2007-11; City of Johannesburg, 2013). Recently, the city has been making concerted efforts to improve the movements of commuters between Sandton and Park station by the use of Location Based Services (LBS). However, little has been known about the movement patterns of commuters between these two centres. In the midst of multiplicity of modes, this study seeks to examine the applicability of Location Based Services (LBS) to determine the movement patterns of commuters between Sandton and Park station. Furthermore, this research seeks to make inquiries on the efficacy of connectivity between multiple micro city centres. Beyond micro city centres, there is need to research bigger areas of interest such as the Johannesburg metropolitan city as a whole.

2.1 Study Area

City of Johannesburg is a well-established economic hub and the fastest growing city in terms of the economy, development and population in South Africa. It is located in the Gauteng Province and has a population of 4 434 827 people as of 2011 census (City of Johannesburg, 2013; Gauteng Department of Roads and Transport, 2013). This metropolitan city is divided into 7 regions that is Region A, B, C, D, E, F and G. Besides it being the over populated economic hub of South Africa, City of Johannesburg as well as its neighbouring metropolitan cities share the most innovative transportation mode (Gautrain) in South Africa linking these three functional cities into one economic region, consequently movement patterns and accessibility becomes a central issue in the City of Johannesburg perpetuated by demand (see Figure 1). However, for the purpose of this study the focus is on Regions E and F comparing Sandton and Park station centres depicted above in Figure 1.

The Gautrain and Rea Vaya are located in the Johannesburg Metropolitan City of Gauteng province, South Africa (Figure 1). The Gautrain alone operates in three metropolitan cities in Gauteng province namely City of Johannesburg, City of Pretoria and East Rand (Ekurhuleni metropolitan municipality). These three areas form a city region which is the economic heartland of South Africa and are the only cities in South Africa having a rapid transit train. The Rea Vaya only operate under the jurisdiction of the Johannesburg Metropolitan City across many communities and micro city centres. These two modes started operating during 2010 when the FIFA World Cup was hosted in South Africa. They also operate along mixed land used as well as major economic, institutional and social nodes such as the FNB stadium, Ellis park stadium,

Wits University, University of Johannesburg, FNB bank city, Nedbank bank city, Carlton centre, Rosebank mall, Sandton convention centre.

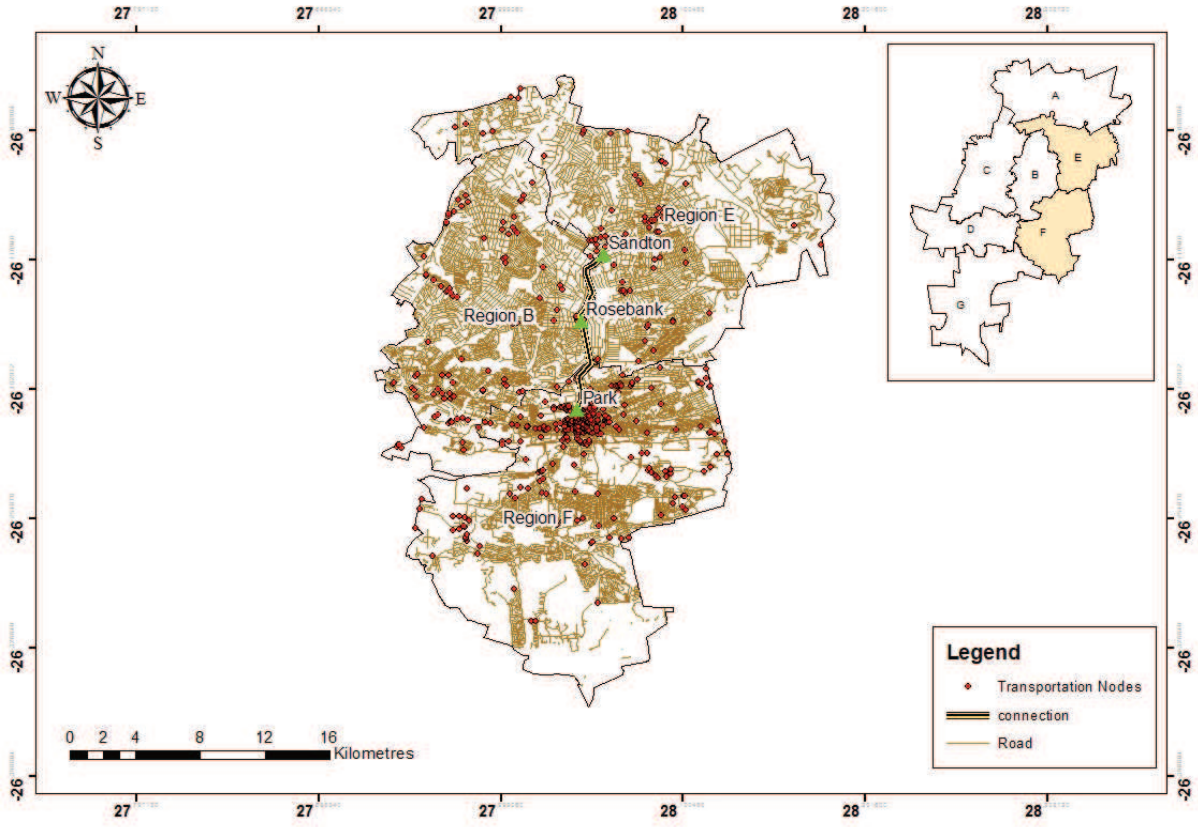

Fig 1: Region E and F, City of Johannesburg, South Africa (Source: Researcher)

City of Johannesburg caters for both motorized and non-motorized urban public transport. These are Metrobus, Metrorail, Rea Vaya bus, Gautrain, Putco, Tuk-Tuk, Uber, Maxi taxis, Minibus taxis and dedicated bicycles lanes for private bicycle cyclists. Urban public transport in the City of Johannesburg is used by the youth to commute to school, to get to service centres and recreational areas; adults to commute to work and recreational areas and by old aged citizens to commute for leisure and to get to basic services. However, for the purpose of this study these two modes of public transport are examined on their commuter movement patterns in Region E and F of Johannesburg particularly regulating focus between Sandton and Park micro city centres.

Park station micro city centre is a major public transport interchange were passengers from all over Africa, South Africa and Johannesburg transfer from trains and buses, buses to minibus taxis and more (SITPF, 2013). Park station situated in Braamfontein bordered by Rissik, Wolmarans, Wanderers and Noord streets is the largest public transport station in Africa. Sandton micro city centre is Johannesburg Central Financial and Business District and it is also regarded as the 'richest square mile in Africa' (SITPF, 2013). Over the years, financial focus shifted from the Johannesburg CBD to Sandton City due to over population and urban decay in Johannesburg downtown. However, this has caused vast movements of people moving in and out of Sandton therefore creating traffic congestion. As a result, traffic volumes have increased between Park station and Sandton City and has caused a continuous overarching traffic congestion problem.

2.2 Study methods

This exploratory study adopted a case study survey research design. A mixed-methods research approach was applied where quantitative, qualitative and spatial data was collected and analysed. The study examined the applicability of geo-location based services in determining the movement patterns of commuters particularly with the intention to compare Sandton and Park station centres. Questionnaires were administered with Gautrain, Rea Vaya, Metrobus and Taxis commuters. Key informant interviews were also conducted with key informant personnel from Gautrain Management Agency (GMA), Johannesburg Roads Agency (JRA) and Gauteng Department of Roads and Transport to give information on movement patterns

ISBN 978-3-9504173-2-6 (CD), 978-3-9504173-3-3 (print)
Editors: Manfred SCHRENK, Vasily V. POPOVICH, Peter ZEILE, Pietro ELISEI, Clemens BEYER

of commuters in the Johannesburg Metropolitan City. Data from Echo-Echo software was used to gather social media comments on the urban public transport modes and locations co-ordinates of where the comments were made. The data in this study was analysed statistically, thematically, semantically, spatially and through time series. The study period is from January to June 2016. The quantitative, qualitative and spatial analysis was triangulated to yield viable results.

3 MODES AND HOW THEY ARE CONNECTED/MOVEMENT PATTERNS OF COMMUTERS

Over the years, urban public transport companies have become more innovative. The internet of things has made it better for urban public transport users to communicate with their service providers. The use of social media has strengthened involvement and communication in society about current affairs, business, politics, brand awareness and most importantly the role of organisations in people's lives. The mosaic of communication threads has allowed different stakeholders in urban public transport such as the Gautrain, Rea Vaya and Metrobus to thrive as smart urban public transport options that are reliable, efficient and safe for commuters in the Johannesburg Metropolitan city. Social media platforms such as Twitter and Facebook have also allowed urban public transport commuters to directly confront challenges faced with urban public transport service providers in real time hence changing their perceptions towards urban public transport and allowing the amount of urban public transport users to grow and thrive.

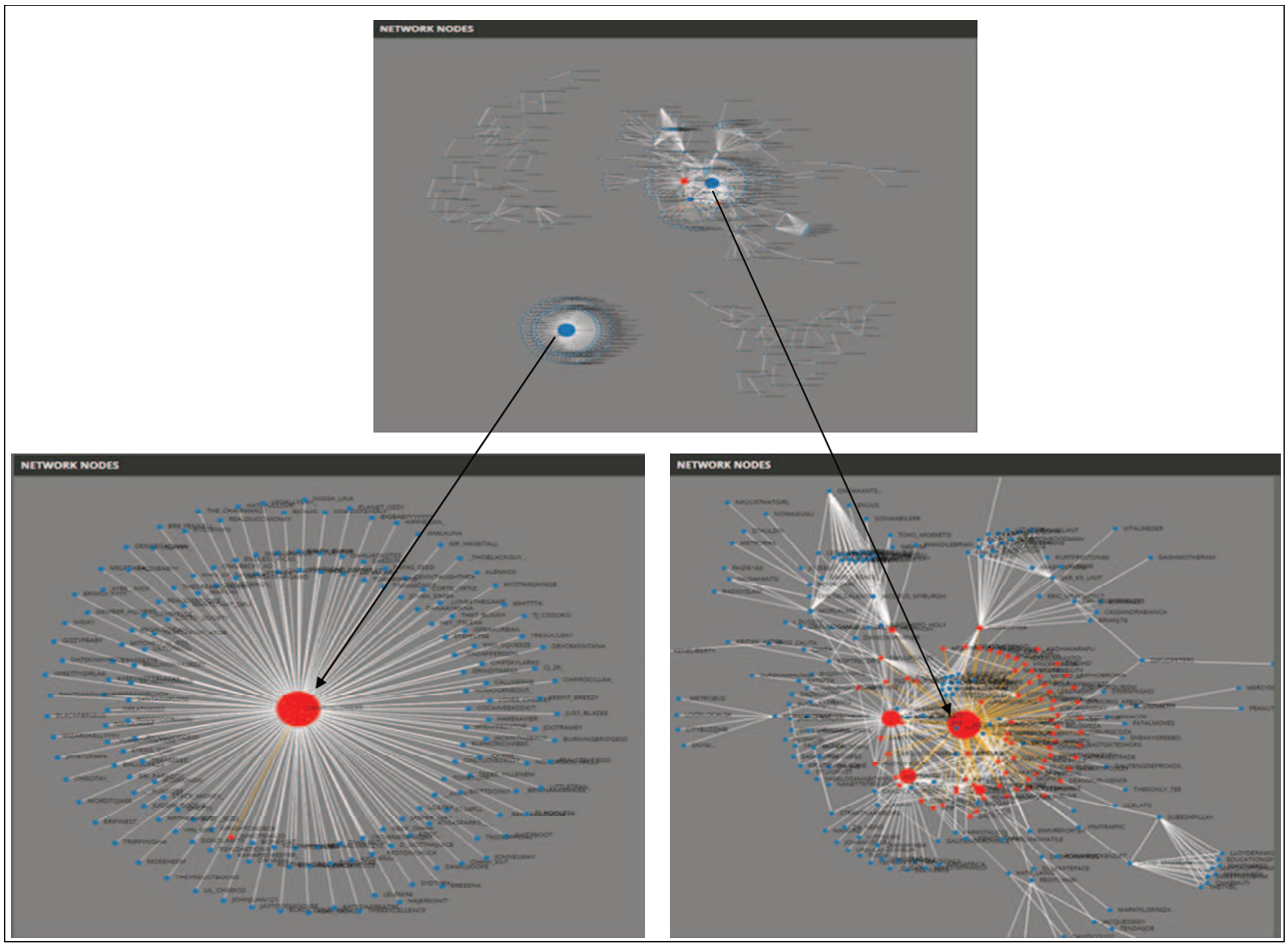

Fig 2: Network Nodes 2016 (Source: Echo-Echo, 2016)

Figure 3 below is a location map of the City of Johannesburg with an indication of the number of tweets and Facebook posts which have been made by commuters using the Gautrain and Rea Vaya bus. The different coloured circles represent different number of tweets and Facebook posts and they are as follows:

- Blue icon = 1 tweet or Facebook post.
- Blue = less than 10 tweets and Facebook posts.
- Yellow = less than 100 tweets and Facebook posts.

- Red = less than 1000 tweets and Facebook posts.
- Pink = less than 10 000 tweets and Facebook posts.
- Purple = less than 100 000 tweets and Facebook posts.

From Figure 3 below, it can be deduced that there is a lot of social media activity taking place in the Gauteng province, specifically between the Johannesburg and Pretoria region. The map indicates that in Johannesburg there is an accumulated 14 104 tweets and Facebook posts which have been made on the basis of trending topics centred on the Gautrain and Rea Vaya. This could be a result of the integration of public transport in the Central Business District (CBD).

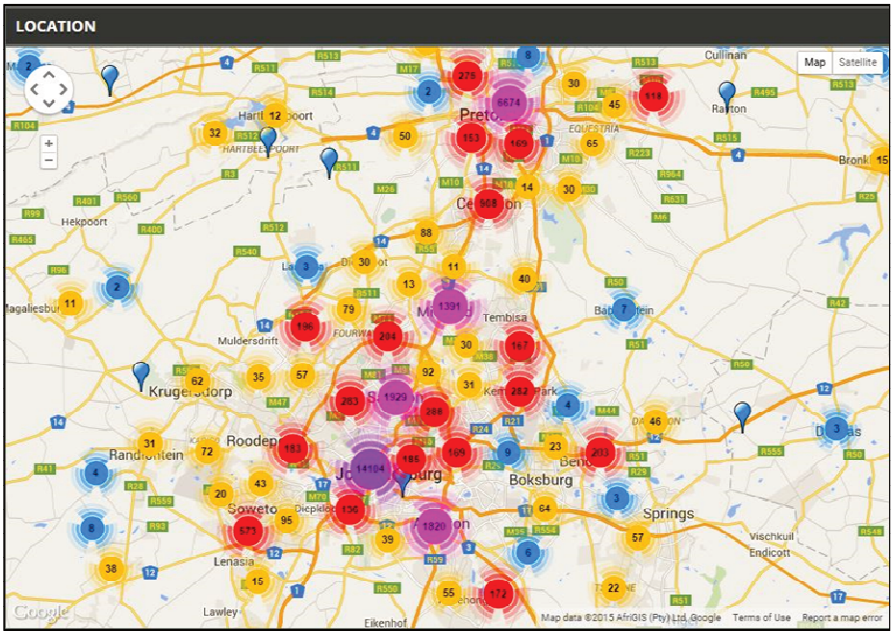

Fig 3: City of Johannesburg Twitter and Facebook posts (Source: Echo-Echo, 2016)

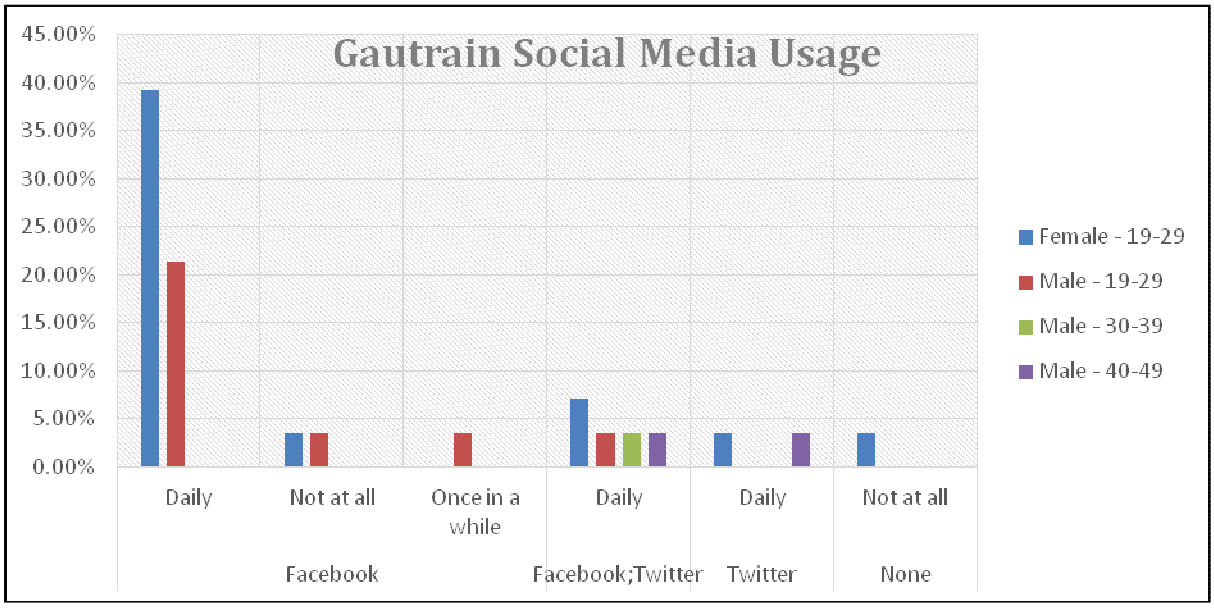

Fig 4: Gautrain Social Media Usage graph (Source: Own Source)

Therefore, more of the tweets regarding the topics on the Gautrain and Rea Vaya are from their commuters and some from residents. Alberton (1820), Sandton (1929), and Midrand (1391) also had the highest tweets and Facebook posts suggesting that commuters, businesses and residents in and around the Gautrain and Rea Vaya stations have been posting topics about marketing, complaints and compliments. These posts also show huge numbers made in locations were Gautrain does operate such as Soweto, suggesting that there are potential clients and need for expansion and integration with Rea Vaya that is currently operating in that area. In addition to feasibility studies and origin and destination surveys, location based services can be

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effectively used to track movement patterns of commuters of urban public transport systems for the effective use of urban public transport provision. Figure 4 below shows social media usage of Gautrain commuters who took part in the study. The graph shows that there were 60.72% commuters who used Facebook daily of which 39.29% were females between the ages of 19-29 years and 21.43% were males between the ages of 19-29.

3.57% of females between the ages of 19-29 years and 3.57% of males between the ages of 40-49 years used twitter daily. 7.14% of females between the ages of 19-29 years used both Facebook and Twitter Daily as compared to 3.57% males between the ages of 19-29 years, 30-39 years and 40-49 years who used both Facebook and Twitter daily. The total number of Gautrain social media users who took part in the study were 89.28%.

Figure 5 below also show social media usage of Rea Vaya commuters who took part in the study. The graph shows that there was a total of 100% Rea Vaya commuters who used social media. A total of 57.69% females and 42.31% were males used Facebook and twitter. 11.54% females between the ages of 19-29 years used Facebook daily and 7.69% females between the ages of 30-39 years used Facebook once in a while. 19.23% females between the ages of 30-39 years; 7.69% females between the ages of 19-29 and 7.69% females between the ages of 18 and less used both Facebook and Twitter daily. 3.85% females between the ages of 40-49 years used both Facebook and Twitter once in a while. 7.69% males between the ages of 19-29 years aswell as 3.85% males between the ages of 30-39 years used both Facebook and Twitter daily.3.85% males between the ages of 19-29 years used both Facebook and Twitter once in a while. 3.85% males between the ages of 30-39 years used twitter once in a while. 11.54% males between the ages of 30-39 years; 3.85% males between the ages of 40-49 years; 3.85% males between the ages of 50-59 years aswell as 3.85% males between the ages of 60 years and more used both Facebook once in a while.3.85% males between the ages of 19-29 years used both Facebook and Twitter once in a while.

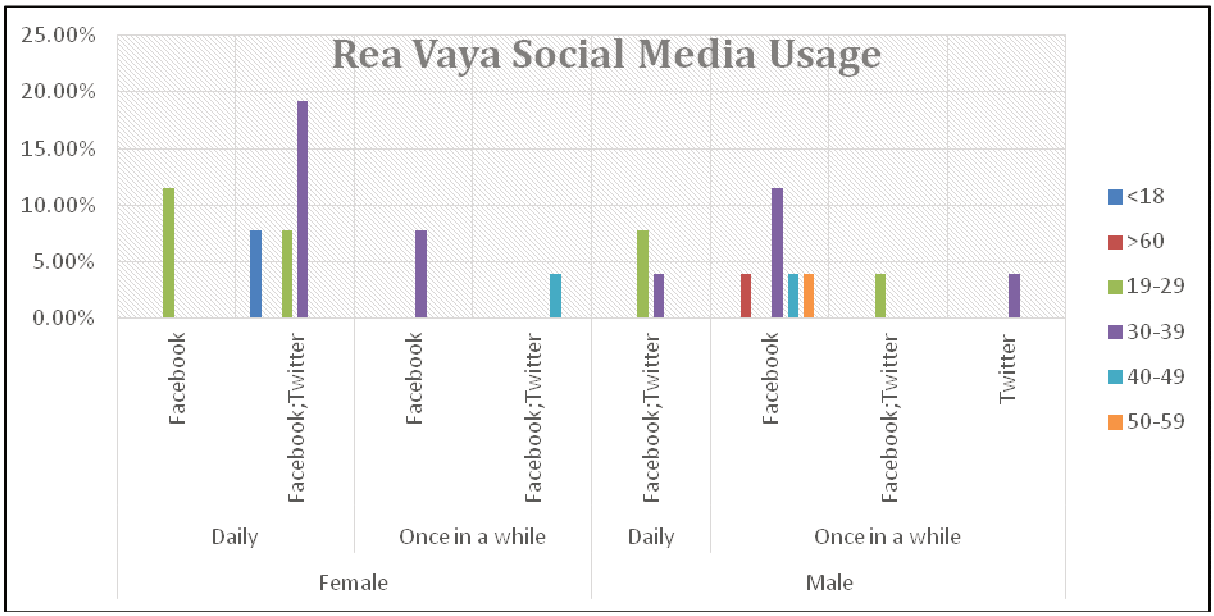

Fig 5: Rea Vaya Social Media Usage graph (Source: Own Source)

These statistics reaveal that most of Gautrain commuters use social media as compared to Rea Vaya commuters and have contributed vastly to the posts obtained from the Echo-Echo software aswell as Co-ordinates. The co-ordinates were converted into shape files that were in turn used to create the focal statistics and krigging maps. These maps show hot and cold spots and help to track movement patterns of commuters using urban public transport and from the survey questions about origin and desination were included to validate locations and create a map with possible routes eminating from different locations to Sandton, Park station and nodes in between.

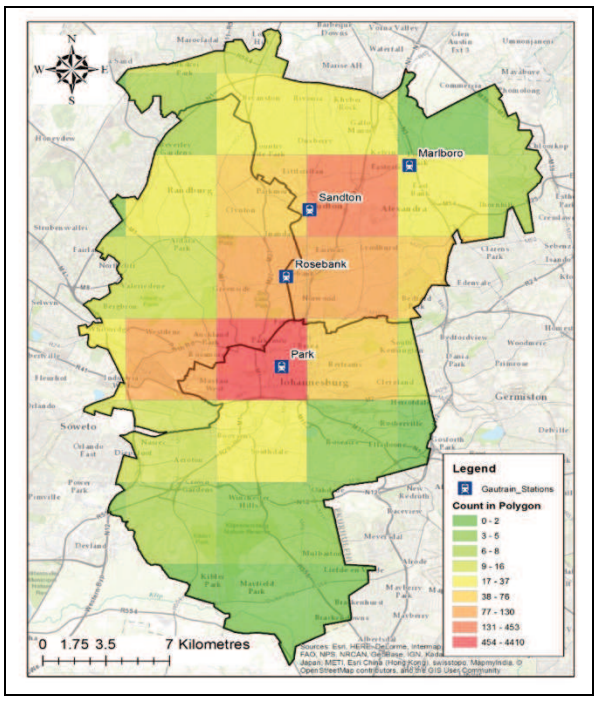

Figure 4: Gautrain Count in polygon for wards (Source: Own source)

Figure 4 above shows hot spots extending from Eastern Johannesburg towards Park station and from Park station through Rosebank and into Sandton. These hot spots are a result of the high frequency of posts made on the Gautrain stations namely Park station, Rosebank station and Sandton station. Furthermore, there are hot spots on the Eastern and Western parts of Park station, Rosebank and Sandton indicating high concentration of posts possibly by commuters of the Gautrain. This is an indication that people move from the East and West parts of Park station, Rosebank and Sandton station to commute on Gautrain for different purposes hence the need for Gautrain expansion to these areas is important. Although the wards vividly represent the hot and cold spots, they visually do not represent real world settings as the shape of the ward is challenging to match in density per square Kilometre.

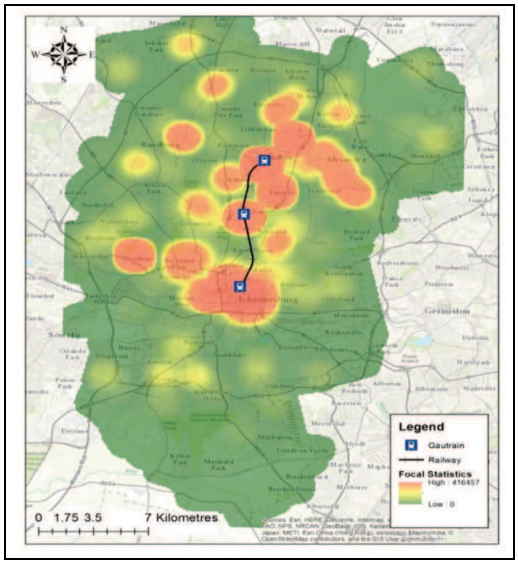

Fig 5: Gautrain focal statistics 6 months (Source: Own source)

However, this challenge is corrected by overlaying a fishnet that analyses the wards in the Johannesburg metropolitan city per 500 metres squared. Figure 5 above shows the time series analysis over 6 months from January to June 2016 respectively. Hot spots are identified mainly in Johannesburg, Rosebank and Sandton. However, there are also hot spots identified in areas not serviced by Gautrain such as Randburg, Westdene, Auckland Park, Mayfair west, Norwood, Fairway, Bryanston and Greenside. The identified hot spots are areas of interest showing high concentrations of commuters even though Gautrain does not provide service

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for some of these locations, therefore suggesting that people move from these locations to Park station, Rosebank station and Sandton station.

Figure 6 below shows hot spots scattered from North West of Sandton, South East and central Johannesburg towards Park station. These hot spots do not cover a wider area, this may be caused by the minimal frequency of posts made on the Rea Vaya bus stations namely Park station, Rosebank station and Sandton station. Furthermore, there are hot spots on the Eastern parts of Park station indicating high concentration of posts made by commuters of the Rea Vaya. The Western parts of Sandton such as Alexandra township hot spots, this reveals the great need for Phase 1C of the Rea Vaya to start operating so that locals can use it to travel from Sandton to Park. There is an indication that people from the East and West of Sandton city are in need of Rea Vaya to commute to various places of interest hence the need for Rea Vaya expansion to the Jukskei Park and Bryanston areas is important. Figure 6 further shows cold spots in most of Johannesburg city, the low concentrations reveals less activity on Rea Vaya in most areas in Johannesburg, although there are Phases of expansion to be developed and completed in the future, the current need for Rea Vaya is prominent.

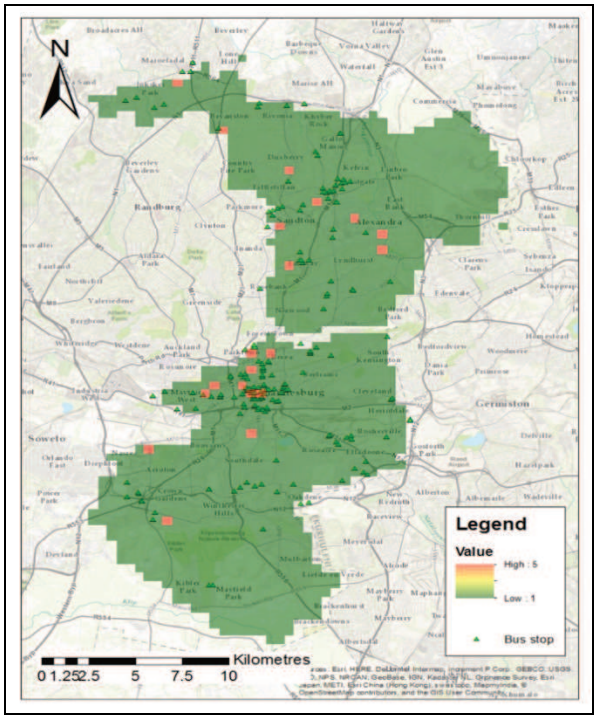

Fig 6: Rea Vaya focal statistics 6 months (Source: Own source)

Figure 6 shows the time series analysis over 6 months from January to June 2016 respectively. The most prominent hot spots are identified mainly in Johannesburg, Nasrec, Jukskei Park, Dusberry, Mayfair West, Berea, Southdale area, Littlefillan, Sandton, Alexandra, Lyndhurst, Crown Gardens, Bryanston, Parktown, Fairway. The identified hot spots are areas of interest showing high concentrations of commuters even though Rea Vaya does not provide services for some these locations, therefore suggesting that people move from their locations using other modes of transport to get to Rea Vaya to travel only in the Johannesurg CBD and areas such as Soweto, Auckland Park, Park town, Cresta and areas in between them. Although there is a Rea Vaya route nearly reaching its final stage of construction linking Park station and Sandton through Louis Botha Avenue, it is not yet operatinal.

Figure 7 shows hot spots concentrated in the Johannesburg inner city as well as some parts of the Eastern, Western and Southern Johannesburg area. However, there are cold spots of low concentrations as the hot spots stretch outwards towards far North and South of Johannesburg. The time series analysis from January to June 2016 shows an uneven but consistent distribution were cold spots are mainly in the Sandton region while hot spots are concentrated in the East, West and central Johannesburg (see Figure 7). The East, West and central Sandton had even distribution of cold spots from January to June 2016. More hot spots are in Park station, Johannesburg CBD, Johannesburg East, West and South as compared to more cold spots in Sandton area from January to June 2016 (see Figure 7).

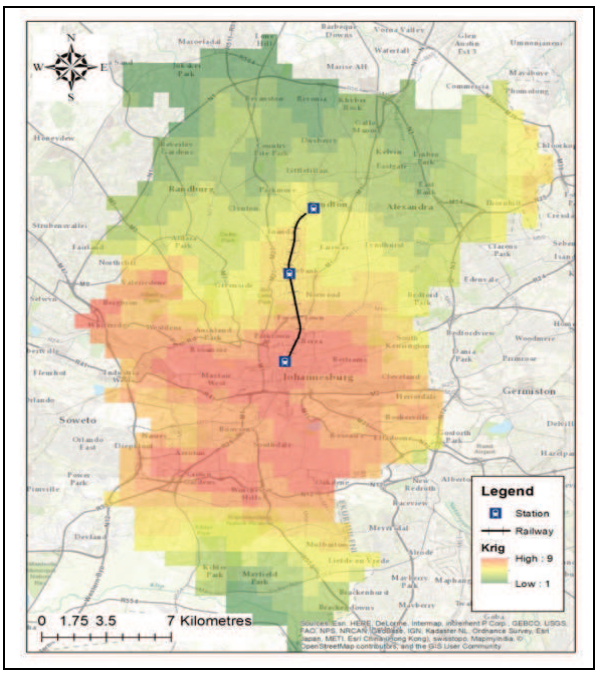

Fig 7: Gautrain Krig 6 month (Source: Own source)

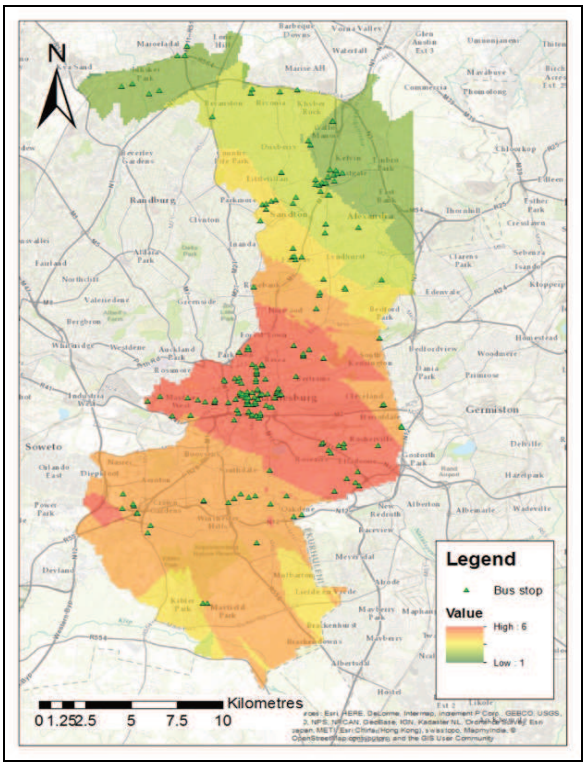

Fig 8: Rea Vaya Krig 6 months (Source: Own source)

Figure 8 above shows uneven depictions of cold and hot spots on geo-statistical analysis conducted on the Rea Vaya. This is due to the small amount of tweets and Fascebook posts obtained from the Echo-Echo software made on the Rea Vaya. The map show analysis based on geo-locational coordinates of posts made from January to June 2016 respectively. Hot spots are visible only in the inner city and Eastern parts of Johannesburg; cold spots were more prominent in the Sandton area. Hot spots were more noticeble in Park station, Parktown, Booysens, Mayfair west, Auckland park, Greenside and Rossmore. Most of the cold spots were in Randburg, Alexandra, Rosebank, Sandton area, and areas in the North of Sandton. this may be due to

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Fig 9: Origin and destination Gautrain commuters (Source: Own source)

Origin	Percentage
Johannesburg CBD	8%
Alberton	8%
Doornfontein	15%
Braamfontein	8%
Germiston	15%
Yeoville	8%
Westdene	8%
Pretoria Silverton	7%
Thembisa	8%
Danville	7%
Randburg	8%

Table 1: Origin of Gautrain commuters (Source: Own source)

Fig 10: Origin and destination Rea Vaya commuters (Source: Own source)

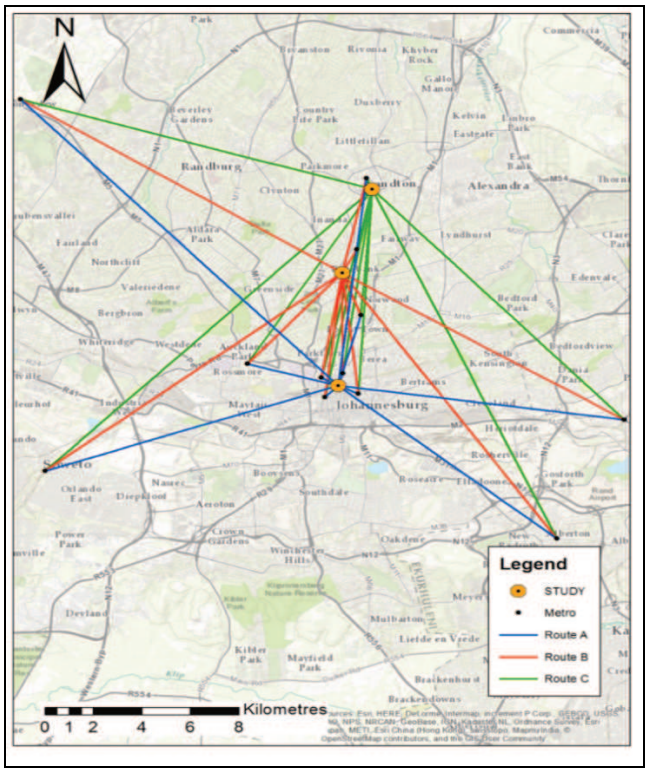
Origin	Percentage
Windsor East	7%
Johannesburg CBD	4%
Soweto	13%
Doornfontein	7%
Alberton	3%
Germiston	3%
Rosebank	7%
Auckland park	7%
Hillbrow	8%
Apel	3%
Hyde Park	3%
Sunninghill	3%
Brixton	3%
Norwood	4%
Melville	3%
Kew	3%
Harare	3%
Westdene	3%
Zimbabwe	3%
Joe Slovo	3%

Table 2: Origin of Rea Vaya commuters (Source: Own source)

Table 1 shows the origin of Gautrain commuters who took part in the study. Their destinations were mainly Park, Rosebank and Sandton stations in order to know where they are going when travelling between

Sandton and Park station. The percentages in table 1 were then used to digitize the map (see figure 11) that shows 3 possible routes originating from points of origins of Gautrain commuters forming catchment areas for possible expansions and developments. Table 2 shows the origin of Rea vaya commuters who took part in the study, their destinations varied. A major issue was that Rea Vaya has not started operating between Park station and Sandton through a direct link, however posts about Rea Vaya have been made in areas not serviced by Rea Vaya hence this shows that people move from these areas use Rea Vaya when travelling in the Johanneburg CBD, Soweto area, Doornfontein, Hillbrow, Auckland Park, Parktown, Cresta areas and there is need for expansion of Rea Vaya to these catchment areas in Table 2 (see figure 11).

Figure 11 and figure 12 is a representation of possible origin and destination areas of Gautrain and Rea Vaya commuters who took part in the study. From the map we can deduce that from each location, a commuter has two or three possible routes that they can take when travelling between Sandton and Park station. These routes may be direct links from their origin to their destinations on may be interconnected through other stations as possible routes to reach the destinations of choice conviniently. These two modes of urban public transport constantly need to track their commuter movement due to change in origin and destinations over time hence the idea of location based services is applicable in tracking commuter movement patterns through geo-locational patterns that show hot and cold spots. The idea is for the service provider to reach out to commuters wether in the form of expanding services or contracting emergency and temporary urban public transport in times when needed most such as traffic jams aswell as tracking social media feeds using location based services analysis software such as Echo-Echo to manage their social media platforms effectively which inturn renders real time and effective service to many of its commuters and the public at large.



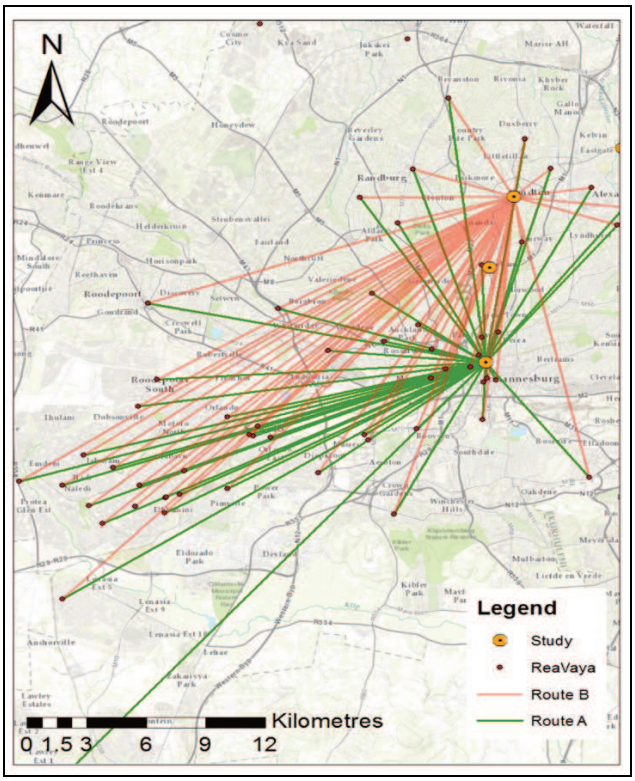


Fig 11: Gautrain Movement of commuters (Source: Own source). Fig 12: Rea Vaya Movement of commuters (Source: Own source)

4 CONCLUSION

Access to the world is at our finger tips. Development is at our disposal, through innovative gadgets such as cellphones, laptops and tablets, anywere in the world anyone can communicate, share information and make the world a better place. Transport development has improved over the years to more sustainable and intelligent systems. To achieve sustainable transport systems, there is need to continously improve transportation and transport systems, hence finding convinient and efficient means of acquiring information through big data has become pivotal in improving transportation, transport systems and other areas of development in general. This study has presented how location based data obtained from social media platforms such as facebook and twitter can be used to model the points of origin as well as movement

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patterns of Gautrain and Rea vaya commuters in the Johannesburg Metropolitan city particurly between Sandton and Park station. Moreover, this study has revealed that beyond the study area, a lot needs still needs to be done in developing urban public transport especially in the outskirts of Johannesburg inner city and Sandton CBD.

Hot spots are identified mainly in Johannesburg, Rosebank and Sandton area. However, there are also hot spots identified in areas not serviced by Gautrain such as Randburg, Westdene, Auckland Park, Mayfair west, Norwood, Fairway, Bryanston and Greenside. The identified hot spots are areas of interest showing high concentrations of commuters even though Gautrain does not provide service for these locations, therefore suggesting that people move from these locations to Park station, Rosebank station and Sandton station. Furthermore, hot spots are identified in some parts of Johannesburg CBD, Mayfair West, Parktown, Alexandra, Sandton, Fairway, lastly between Dusberry and Littlefillan. However, there are also hot spots identified in areas not serviced by Rea Vaya such as Dusberry, Sandton, Jukskei Park, Littlefillan, Alexandra, Fairway, Bryanston and Lyndhurst. The identified hot spots are areas of interest showing high concentrations of commuters even though Rea Vaya does not provide services for some these locations, therefore suggesting that people move from their locations using Rea Vaya to travel betweem Park station and Sandton. There are many areas that are marginalized from Gautrain and Rea vaya bus development in the Johannesburg Metropolitan city, reasons may be that there is no market for these services to sustain operational costs. On the contrary the model shows hot spots for locations that need services from Gautrain and Rea vaya and are currently not serviced. As a result, Location Based Data (LBS) is applicable in determining movement of commuters and may assists interested professionals and stakeholders when making informed decision in development.

The data used in this study was conducted for a time period of 6 months from January 2016 to June 2016. Moreover, there is need to increase the time period for further studies especially for all Regions of the City of Johannesburg to increase accuracy and validity of results and to track variations between time periods in different locations. Although the model has proved that LBS are applicable in determining the movement patterns of Gautrain and Rea vaya commuters between Sandton and Park station, it has also revealed that LBS provided is highly dependent on geo-locational coordinates which needed to be accurate. In this study, gaps were identified from the data collected from LBS. The LBS data had some unidentified variables that caused errors when processed, as a result the data needed to be cleaned and only data that had geo-location co-ordinates was used to create the maps. In addition, the posts from social media posts are not stating wether people who post are actual Gautrain and Rea Vaya commuters or are possible commuters. In summation, this study discussed and examined the applicability of location based services in determining movement patterns of commuters in Johannesburg Metropolitan city.

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ISBN 978-3-9504173-2-6 (CD), 978-3-9504173-3-3 (print)
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