MAPPING TOURIST MOVEMENT PATTERN USING GLOBAL POSITIONING SYSTEM (GPS) AS AN AID TO SUSTAINABLE URBAN ATTRACTION MANAGEMENT

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Abstract

Understanding tourist movement pattern is crucial for tourism stake holders to produce a viable tour product and offering quality place of interest and preference. This is due to the fact that it can increase tourist choices and satisfaction as well as generating opportunities and impacts for destination management as well as generating critical mass for economic benefit of the attraction. However, the theoretical knowledge on how tourist actually move still in the stage of debating where some researcher believe that tourist move influence by their motivation and individual behavioral and the other researcher argue that tourist actually move based on the setting of urban scape and facilities provided in the cities. This situation will limiting the ability of destination stakeholder or authorities to acquire sufficient information in determine tourist relevancy on selection of activities, spending pattern and use of space. Lack of knowledge on this scenario will lead the tourism planner designing the incompatible facilities and activities in the tourism destination for the tourist. Another vital need to understand on how tourists move is due to sharing the spaces with the local residence and the collision between them may lead to positive or negative impact depending how the policy makers and tourism planner provide the facilities and urban infrastructure. Majorly the tourism destination in south East Asia still lack of attentiveness when it comes to planning the tourist development. The tourism authorities develop the tourism product based on the assumption that they believe the tourist need but not based on the how the tourist really behave when their going on holidays. The emergence of advanced tracking technologies such as Geographic Information System (GIS) and Global Positioning System (GPS) is potentially being seen as suitable tools to recorded precisely on how tourist interchange and easily been updated from time to time. The high-resolution data gain from GPS could be used to regulate the carrying capacity of tourism sites more rationally, develop new attractions, improve the allocation of accommodation services, and reduce friction between tourists and the local population. In the prospect of developing countries mainly in the south-east Asia region, such technologies can help the tourism authorities to develop the quality place of interest and preference based on the data acquired from how the tourist behave at the destination level so the product that been offer will give benefit from various side. Considering using such system is still at its infancy and from the view of tourism planner it is relatively new and not expanded into its maximum potential.

Keywords: TOURIST MOVEMENT PATTERN, ADVANCED TRACKING TECHNOLOGIES, URBAN ATTRACTION MANAGEMENT AND TOURISM DEVELOPMENT

1.0   INTRODUCTION

Mobility or movement is unquestionably an essential aspect of contemporary life (Drummond et al., 2006) and eases practices and should be a key object in tourism research. Beside of this, the difficulty of collecting data on the spatial behavior of visitors (Meng et al., 2005) generally delays the development of tools for a better planning and management of attraction in the destinations, which actually reflect how visitors move around and how they take their decisions in a space-time environment. In order to produce a viable tour product and offering quality place of interest and preference, it is vital for tourism stakeholder to

understand tourist movement pattern. This is due to the fact that it can increase tourist choices and satisfaction as well as generating opportunities and impacts for destination management.

Understanding on how the tourist move through and the usage space and time will give bigger implication for infrastructure and transportation development. During the tourist's visit, destination managers and businesses hope that the visitor will make choices which lead them to take full advantage of what the city has to offer and thereby distribute tourism's benefits broadly (Crouch & Ritchie, 1999). This information will also assist tourist organizations to design more appropriate and profitable tour packages. A good trail and itinerary design can support tourist in such tasks as determining their location within a setting; determining their destination; developing a plan to take them from their location to their destination, including identifying places of interest en route; and reducing frustration and wasted time (Edward & Griffin 2013).

2.0   LITERATURE REVIEW

Gaining deeper knowledge on the factor that influence their movements will help tourism planner in managing product development, planning of new potential tourism attraction, destination planning as well as management of environment and socio-cultural impact of the destination. Tourist movement always been related between long distance transportation such as airplane with the tourism, but the connection at the destination level is still blurred (Prideaux, 2000). Fennell stated that recently only few attempt to model the actual tourist movement patterns (1996). This is due to that movement pattern is so essentially understandable that its form and practice are taken granted and often overlooked (Haldrup, 2004).

Edward & Griffin stated that examining on how tourists move around a city and in particular the factors that constraint that movement may well be fundamental to devising ways to enhance their quality of experience within the city (2013). This scenario can give an impact on economic sustainability and also lead to viability of businesses that cater the tourism demand. If it looked in the long term condition, the tourist may experience satisfying journey that generate repeat visits and also good word of mouth. The major activities of urban tourists are widely recognized as sightseeing, walking, shopping, and sitting in restaurants and cafes. Although these activities appear to be clearly set in time and space, so far relatively little attention has been paid to visitor mobility within the fields of human geography and tourism research (Shaw et al., 2000).

Understanding where tourists go within a city and how they negotiate their way from one point of interest to the next is not something discovered through subjective observation (Edwards, Dickson, Griffin &Hayllar, 2010). If look from a public-policy perspective, an effective wayfinding systems can help spread visitor expenditure more broadly throughout the city (Edward & Griffin 2013). Destination management tries to convey tourist flows in avoiding overcrowding at single places and take advantage of the entire destination area (Gretzel et. al., 2006). Unfortunately the data about tourist spatial behavior is hardly collected and assessed due to lack of a suitable method (Gretzel et. al., 2006). Today city councils has spent a lot of capital in term of tourist information facility and marketing campaigns, but they did not having any information about their success.
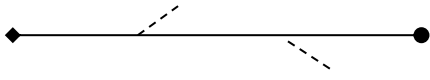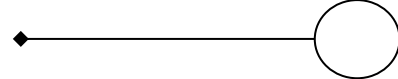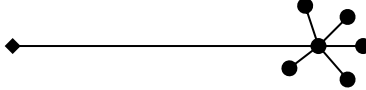
Movement is the act or process of moving; especially: change of place or position or posture (Merriam-Webster 2004). Movement represents a nonstop phenomenon on a

timeframe. In order to characterize this continuum, movement can be discretized on a grid (Raper 2001). It is a dynamic process that is characterized not only by spatial and attributes components, but also by temporal references (Worboys & Duckham 2004). Time can be measured as a linear dimension. Obtaining a deeper knowledge on the factor that influence the tourist movements will assist tourism planner in managing tourism product development, planning of new potential tourism attraction, destination planning as well as management of environment and socio-cultural impact of the destination. Structure of movement can be represented as a group of time stamped states. Referring to the coordinate system, at a time point, movement act as (x,y) representing spatially points. Movement pattern can be seen as a network during a time interval. Nodes of network are the time point or spatial point when movements stop. The edge of network is the path of a continue moving that will connect two spatial points basically represent the roads. Illustration of this network can represent collection of time slices that are integrated together to show the spatial distribution from past to present (Ott & Swiaczny 2001). This movement network actually represents a tourist movement. The network is controlled by the road network in a physical setting. Tourism attraction will be the nodes of the movement network. The roads that act as the edge of network will connect the attractions. The theory to describe this movement network is that tourists move from one attraction to the other attractions along the roads and stop at attractions or nodes.

In fact the stop that is been mentioned does not mean that tourists only stance on one point without change their position and speed. It shows that tourists move around in small area within the attraction without change their position in a large space. Each node or attraction has two sequential attributes: arrival time (time point) and period (time interval). The construction of movement, hence, can be simplified as sequence of combination of attractions (position) and their arrival time and duration. The edge of network is the path that tourists may choose when they travel between one attraction to another attractions. The path can be a combination of more than one road. The path is allocated a direction and sign such as speed limit or road signage. The vital sequential attributes for edges is time length. The issue that always been discuss for example, how long the time takes for the tourist to travel form one attraction to another.

The simplest route style contains a single main destination, go and back trip with or without having a side trip. A second route type will contains a transit leg to the place of interest or attraction, followed by a circle tour stopping overnight at numerous points and then returning by the original transit route (McKercher & Lau, 2008). The third style contains a circle tour with numerous stops, where the tourist not doing any transit leg again. The circle tour may be involved where land transportation may be the only mode of transport available, or may be open-jawed where the involvement of air transportation. The final pattern is a hub-and-spoke pattern, where tourists base themselves in a destination area and take side trips to other destinations (McKercher & Lew, 2004). Refer figure 1 below for the illustration of movement sytle. Since macro- and micro-destination patterns give a view of tourist movements at different scales, understanding macro-destination patterns might notify the conceptualization of micro-destination movement patterns, but it not may represent them exactly. Scale considerations make the test of modeling movements between one to another destination much easier than model movements within a destination level. Macro-destination movement models basically the integration of two components which are a transit leg and a destination touring element. All travel that been made will involves several transit legs start from the origin to a destination region and then going back again or, in the some case of multi-destination trips, travel between destination regions.

Figure 2.1: Itinerary types

	Lue et al. (1993) x 2 Mings and McHugh (1992) x 1 Oppermann (1995) x 2 Flognfledt (1999) x 1 Lew and McKercher (2002) x 1
Single destination, with or without side trips	
Transit leg and circle tour at a destination	Mings and McHugh (1992) x 2 Lue et al. (1993) x 1 Oppermann (1995) x 1 Lew and McKercher (2002) x 2
Circle tour with or without multiple access, way out points; different itinerary styles possible at different destination areas	Mings and McHugh (1992) x 1 Lue et al. (1993) x 1 Oppermann (1995) x 3 Flognfledt (1999) x 1 Lew and McKercher (2002) x 2
Hub and Spoke Style (From home community or destination area)	Lue et al. (1993) x 1 Oppermann (1995) x 1 Flognfledt (1999) x 2 Lew and McKercher (2002) x 1

Source: McKercher and Lew (2004)

Mapping tourist movements within a destination level is complicated by the practically limitless number of attractions that tourists may visit during the holiday. The sequencing order between places can become unpredictable; because each tourist has the unique needs and wants of individual may follow no logical pattern (McKercher & Lau, 2008). Leiper (1990) stated that each tourist operates within his or her own individual tourism system. These systems may intersect at some points, but each is discrete. If look at the stage of destination level, his work recommends that each tourist movements may be unique, even though the patterns may involve visiting many of the same attractions.

Leo van den Berg and his collaborators have suggested the "European Model" that emphasized the "harmonious development of the city" rather than the construction of separated tourist spaces (van den Berg et al., 2003). Their studies at several cities in Europe show that planners and policy makers in those cities considers more towards "displacement of resident-oriented activities, redevelopment, and cultural friction" when developing tourism (van den Berg, 2003). Balancing of local needs and economic development projects requires and over-arching political vision that is rarely possible in cities where leaders feel desperate for development at almost any cost (Judd, 2003). The early effort on applying advance tracking technologies such as GPS device in understanding tourist movement at destination level was conducted at historic city of Old Jaffa, Israel by Noam Shoval and historic city of Tarragona, Spain by the Department of Geography University of Rovira I Virgili.

This shows that the researcher tend to test the research at the historical city. In European cities, the richness of cultural heritage and architectural authenticity of urban cores has been recognized as a main attraction for tourists; that may lead tourism development to aim at enhancing the character of the city. Likewise, planners in Vancouver, Canada have viewed tourism as a natural-by-product of policies that emphasis neighborhoods, urban amenities, and the environment (Artibise, 2003). Even in case of Montreal, a city that has stressed mega-projects such as Expo 67 (the 1967 World's Fair) and the 1976 Summer Olympics no tourist bubble has developed; visitors to the city often walk through the downtown and neighborhoods (Levine, 2003). Mexico City is one of interesting example where it has focused its energies on the development of an enclave in the historic center- a strategy virtually forced on the city by its high crime rates. But in spite of these conditions, the planners are trying to make the enclave a place necessary for local people as much as for tourist (Hiernaux-Nicolas, 2003).

Tourist share spaces and places within the city with permanent residents which doing their normal daily routine business of working, shopping, commuting, playing and education, and at the most famous places at most times of the year the population of tourists will be outnumbered. Even then, many of the places within a city where tourist congregate in great numbers may also be significant places for local recreational and entertainment activities (Edward & Griffin, 2013). The changing geography of urban spatial structure reflects the rise of an urban culture that revolves around "quality of life" concerns (Clark et al., 2002). Distinguishing visitor from "local" spaces is getting increasingly difficult because leisure, entertainment and cultural sectors are continued as crucially used by local residents as by out-of-town visitors. When not going elsewhere, local people usually participate in activities that are in distinguishable from what tourists do such as go to the mall, dine out, attend a concert and walk along the waterfront.

Residents increasingly act like tourists in their own cities (Lloyd, 2002). This situation gives difficulty to tourism planner to understand and distinguish between how actually the real tourist behaves and how the local tourist behaves doing what the tourist do. If tourism planner cannot distinguish the behavioral between them, the authority and local council may decide the inappropriate tourism development because it may include the local resident experience who doesn't need the quality of experience and satisfaction when going holiday. The actual tourist experience and satisfaction is crucial to help tourism planner in providing ideal tourism development, facilities and products.

3.0 GLOBAL POSITIONING SYSTEM (GPS) AS A SUITABLE APPROACH IN CAPTURING DATA ON TOURIST MOVEMENT PATTERN

In the inter-destination level, researcher usually used an inductive, empirical-led methodology, like mapping or listing the planned destinations and stopovers. Nevertheless, this approach has number of limitations that have inhibited further investigation beyond initial explanatory studies (McKercher and Lew, 2004). This mapping technique can only be relying on small scale maps which will lead in loss of data detail. Due to this scenario, the destinations and stopovers as listed cannot be assumed with confidence. This situation occurs due to the limitation of the researcher on gaining the data of tourist movement because the need to observe, follow and mapping the tourist movement manually and simultaneously. Table 3.1 shows the techniques, advantages and disadvantages that are suitable for obtaining data in mapping tourist movement pattern.

Table 3.1: Advantages and disadvantages of various counting and tracking techniques

TECHNIQUE	ADVANTAGES	DISADVANTAGES	SCALE LEVEL
GPS tracking	• High resolution • Mature technology • Ease to use • Continuous measurement • Uninstructive	• Low sample size-limited by equipment • GPS signals blockage from buildings and foliage • High risk of loss of GPS equipment • Expensive	MICRO LEVEL
Timing systems	• Non-Intrusive • High resolution • High sample size	• Expensive • Limited by battery life and data logger memory capacity	MICRO LEVEL
Camera-based systems	• High resolution • Can identify unique individual • Can work as surveillance, counting, and tracking tool	• Vibrations and changes in light, height, and temperature could degrade performance • Expensive • Intrusive/ ethical issues	MICRO LEVEL
Mobile phone tracking	• Non-intrusive • Low-cost	• Privacy security issue • Signals blockage from buildings and foliage • Immature technique • Low resolution • Ethic issue	MICRO LEVEL
PDA Tracking	• High resolution • Can communicate with tourists in real-time • Can track their decision making process	• Intrusive • Low sample size • Signals blockage from buildings and foliage • High risk of loss of PDA equipment • Expensive	MICRO LEVEL
Manual observation and interview	• Can communicate with tourists • Can classify vehicles more accurately • Can count or track tourists more flexibly • Can acquire non-spatial • information of	• Intrusive • Time-consuming • Low resolution • Low sample size	MACRO or MICRO LEVEL

Self-administered questionnaire	• Can acquire non-spatial • and approximate spatiotemporal information of tourist • Can count or track tourists more flexibly	• Intrusive • Time-consuming • Low resolution • Low sample size	MACRO LEVEL
	• Can track tourists' decision making process		

<p style="text-align:center">Source: Infodev, 2004</p>

Based on the table above, GPS is the most suitable tools to track the tourist movement at the destination level now days. Although GPS is one of the expensive tools compare to others, over the past nine years, the rapid advancement and availability of small, cheap and reliable tracking devices drawing on GPS technology make it good in assisting researcher to develop new methods on spatial research (Edward & Griffin 2013).

Moreover, while having the difficulty in gaining accurate data and information on tourist movement pattern; researcher also faced another problem that also has a relationship in order to understand tourist movement pattern which are tourist behavior and their motivation while visiting a place. Mapping tourist movement would be easy if it based on the transportation geography of a place only when tourist shared the same interests and sought to optimize their visit in the same way (McKercher and Lew, 2004). However, tourist behavior can be the intervening factor that influences individual travel decision making in destination level (McKercher and Lew, 2004). Toward this, in order to get an accurate and neat data on tourist movement pattern, researcher also needs to look on the tourist behavior and their motivation when they go to travel. The difficulty arises when the data on tourist movement pattern and tourist behavior need to go through multiple staged before it can be useful to the researcher. So this will cause the delay on the obtaining the data and lead to the usage of huge amount of capital cost and labor. At this stage where GPS play its role as the solution because using it can obtain the data on tourist movement patterns and their behavioral to move in such ways simultaneously. Table below show an attempt to apply advanced tracking technologies such as GPS in order to deeply understand the tourist movement and their behavior as shown in Table 3.2.

<p style="text-align:center">Table 3.2: Example of case studies in understanding tourist movement using GPS</p>

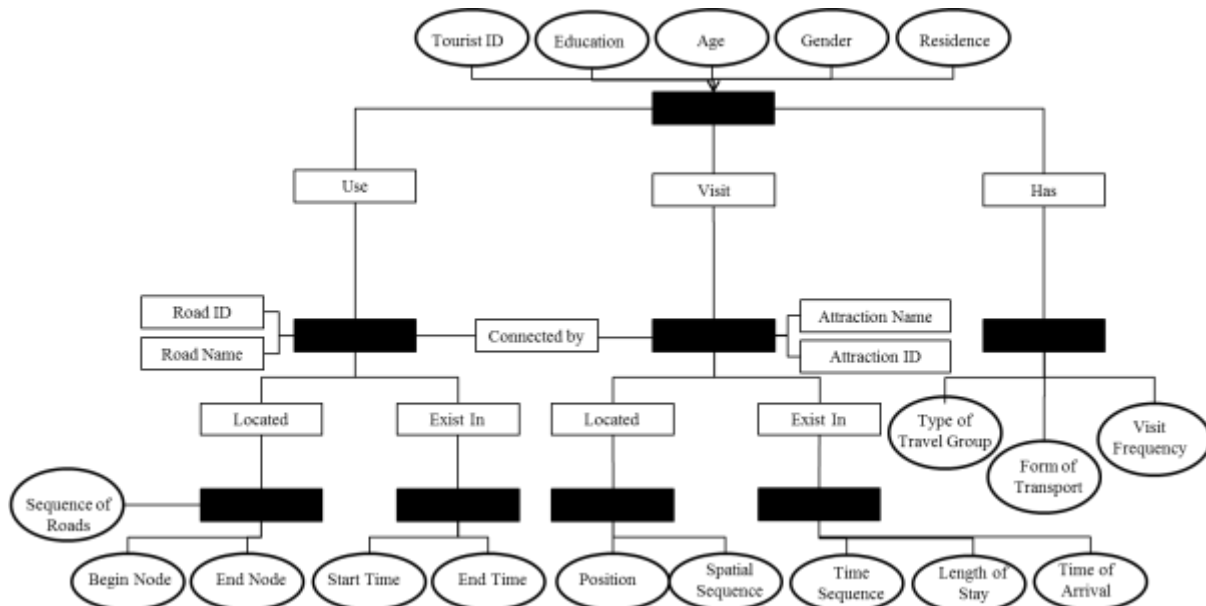| Year	Author	Case Study	Main Finding
2004	Kempermann, Chang-Hyeon & Timmermans	Record significant difference between first time and repeat tourist to a theme park	• New visitor try to attend as many attractions as possible • Repeat visitor were most selective and focused.
2008	Shoval	Tracking tourist in historic town of Akko (Israel)	• identify areas of congestion and under utilization • highlighting in efficiencies in economic and social

<p style="text-align:center">7</p>

			resources
2008	Van Der Spek	Tracking a series of pedestrian on visitors in three European cities: Norwich (United Kingdom), Rouen (France) and Koblenz (Germany)	▪ Provide good insight into the behavior of visitor such as walking distance, duration, familiarity ▪ visitors to each city act in different ways
2012	McKercher, Shoval, Ng & Birenboim	Comparing visitors' behavior pattern of first time and repeat tourist to Hong Kong	▪ First time visitor tended to sample the destination, wandering through the city often by foot ▪ Repeat visitor concentrate their activities in fewer places and disproportionately

Source: Adapted from Edward & Griffin, 2013

4.0 INTERPRETING DATA COLLECTION ON TOURIST MOVEMENT PATTERN USING ENTITY RELATIONSHIP MODEL

Although GPS are realible and appropiate tool to help researcher in understanding deeper regarding tourist movement pattern in a destination level, the data acquire from the GPS device still cannot intepreted how the tourist actually move. An integration with the Entity Relationship Model is needed for researcher to extract the database collected from the GPS devices.

Figure 4.1: The ER Model for Tourist spatio-temporal movement database

Source: Xia, 2003

Database is a collection of information that is organized in an efficient way for computer process (Elmasri 2000). Tourist spatio-temporal database deal with information related to tourist and their spatial movement and temporal reference. This database is organized as a relational database. All the information is presented as a collection of relations. Each relation is shown as a table. Columns are attributes and rows ("tuples") are entities (Dilip 2005). For example, The Entity-Relationship (ER) model above shows that the basic entities in the database are tourists, roads, attractions, travel mode, space, and time. The attributes of tourist include ID, age, gender, residency, and education. Different tourists might have various travel modes, visit different attractions and use different roads. Travel mode refers to form of transport, visit frequency, and type of travel group. Attractions visited by tourists are located in space with attributes as position. A movement is represented spatially a sequence of attractions. Movement in time reference, represented as a sequence of time intervals (or time categories), has attributes of length of time to stay, arrival time at an attraction, start time for tourists to enter road and end time to leave the road. Attractions are connected by roads that are also located in space and stored in the computer as an object with attributes as ID, start nodes and end node.

5.0   THE NEED FOR FURTHER RESEARCH

Based on the literature that been discussed above, the issue and question arise into two main criteria which are issues in term of theoretically knowledge on tourist movement pattern and also in term of methodological perspective. In the aspect of theoretical, the argument whether tourist move based on their behavioral or based on the setting of urban scape and facilities provided in the cities. So there is a need to test in which perspective is true in deeply defining the tourist movement pattern. Other than that, the planner should know how the tourist move because the visitor usually share the spaces with the local residence and the collision between them may occur positive or negative impact depending how the policy makers and tourism planner provide the facilities and urban infrastructure. Looking at the methodological perspective, in order to get solid understanding on the tourist behavior researcher need to get accurate data on how tourist use the space and time when they move around the cities. This data can be obtain by the usage of advance tracking technologies like GPS to recorded precisely on how tourist move and easily been updated from time to time. Therefore, the integration is required by the town planner in designing activities in urban area.

6.0   CONCLUSION

Based on the discussion, it clearly shows that understanding tourist movement pattern is a crucial aspect to be gain by the city council, tourism planner and local authority to planning a better tourism destination. This is because it is important for development and designing a tourism itinerary and arrangement the place of interests that meet the tourist satisfaction and expectation. In practical term, the high-resolution data gain from GPS could be used to regulate the carrying capacity of tourism sites more rationally, develop new attractions, improve the allocation of accommodation services, and reduce friction between tourists and the local population.

7.0   ACKNOWLEDGEMENT

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