INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 11, No. 5, p. 161-168, 2017
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Reducing fear of crime through spatial configuration analysis for urban sustainability in mixed-use neighbourhood

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Article published on November 22, 2017

Key words: Space syntax, Fear of crime, Spatial configuration, Axial line, Integration value

Abstract

Fear of crime is an important social problem which has the negative impact on sociability and quality of life. The isolated streets are defined as urban spaces where fear of crime is highly perceived. Feeling safe depends on the knowledge about the environment which needs the awareness of where you are in the space. Thus, it is considered that spatial knowledge is crucial to evaluate feeling of safety. This study aims to investigate the relationship between fear of crime and space configuration in Mixed-use neighbourhood. The study focused on accessibility measures based on the axial line street model in order to define safe spaces and fearsome in urban street space. The main method and procedures used include: space syntax method to analyze space configuration characteristics of the study areas and questionnaire to examine the fearsome and safe places. Axial analysis, as the analytical tool, is applied to provide the opportunity for exploration of accessibility patterns of a space network. Furthermore, integration value, level of connectivity, and choice level as the accessibility measures are calculated by Depthmap software. The Pearson product-moment correlation coefficient was computed to investigate the relationship between syntactical variables and safe and fearsome place. Taman Universiti neighbourhood in Malaysia is chosen as the case study. The findings show that to have a safe walkable space is essential to consider integration values, connectivity and choice value in planning and designing the urban street networks.

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Introduction

Crime and fear of becoming a victim have always been the major concerns for the general public in the world. In fact, achieving the sustainability could be faced with the significant challenges in presence of crime and fear of crime, because an "unsustainable city" is generally determined by: "images of poverty, physical deterioration, increasing levels of crime, and perceived fear of crime" (Cozen, 2002). Crime has various types such as theft assault, robbery, burglary, street violence and many more. It relates to a specified material or situation, while fear of crime depends on the feeling or perception of the environment. Fear of crime is defined as a response to the properties of the space and is more general than the crime itself (Hutchings, 1994).

One of the most significant social problems is fear of crime, which affects the quality of life and destroys the social relations (Hedayati Marzbali *et al.*, 2012, Torstensson Levander, 2007 and Zedner, 2009, Savina *et al.,* 2013). Previous research findings have shown that fear of crime has a negative impact on walking in public spaces (Sallis and Kerr, 2006), and it is one of the important factors in reducing the amount of walking among the people (Ellaway *et al.*, 2005).

On the other hand, designing walkable cities is an important facet in creating a low-carbon society (Low Carbon Society Blueprint for Iskandar Malaysia, 2025). Therefore, reducing the fear of crime could enhance walking in cities and consequently, lead to sustainability.

Although, the relationship between crime and space has been investigated in numerous studies and their results shown that crime occurrence is related to the spatial configurations of the space, but the correlation between fear of crime and space needs more verifications. According to the Lang (1994) "Feeling safe depends on the knowledge of the environment which needs the awareness of where you are in the space and time". Therefore, spatial knowledge is essential to evaluate feeling of safety.

This paper reports on an ongoing study that examines the relationship between the fear of crime and spatial configuration in mixed land use neighbourhood. It investigates how space syntax analysis of the neighbourhood spatial configuration is related to the fear of crime. It leads to find the characteristics of vulnerable spaces in a certain neighbourhood. This study attempts to propose a street network structure for the safe walkable urban space.

Materials and methods

Space Syntax Methodology

Space syntax is a particular analytical methodology, which was developed, by Hillier and Hanson (1984) with their team of researchers at University College London that applies mathematical techniques and attaches quantitative values to the relationships of spaces from the macro to the micro scale for urban environmental design. Space syntax is a language used for describing urban space. Based on the theoretical background of space syntax method, this technique explains the relationship between spatial environments and users' behaviors. Thus, it is thought to be the adequate approached for the goal of this study.

Analytical Tool: Axial Map of Analysis

However, axial line application is a technique which is used to compute a set of measurements of syntactical characteristics of space. Axial lines refer to the longest visibility lines (the longest collections of lines of view) that pass via all open spaces in a studied region (Kim and Penn, 2004). According to the literature review about this technique, it is figured out that axial line can be regarded as, from the view of how human perceive space, a unit space "vista space" (Jiang *et al.,* 2000). Based on the fundamental idea in space syntax, through the analysis of how these unit spaces are connected or integrated to each other; the spatial structure of the urban space can be understood and human social activities among the space can be predicted (Hillier and Hanson, 1984; Mahdzar, 2008).

Accessibility measures which reflect the characteristics of urban spaces is required to find the relevance among the urban configuration and pedestrian fear of crime. Accessibility measures include connectivity, global integration, local integration and choice.

Case Study

Taman Universiti neighborhood, a mixed land use neighbourhood is chosen as a case study. It is a university town near Johor Bahru City in Malaysia (see figure 1 and 2). The most important component of this neighborhood is the design of commercial streets to support the activities, functions by the people who work or live there (Jacobs, 1961). This area has different land uses with various activities, which allows the research to evaluate pedestrian fear of crime that they might be facing in the area.

Measures and Procedure

Depthmap software is applied to analyze the spatial configuration, ie the spatial structure of the neighbourhood. Through preparing the axial model of neighbourhood, this study examines space syntax measures such as integration values (global and local), levels of connectivity between spaces, and choice. These measures calculated in Depthmap are based on the shortest-path, from a topological perspective, between two axial lines on the map.

Questionnaires in a form of the map of the neighbourhood area were applied in order to examine which places are fearsome or safe. Participants were asked to define the safe and fearsome places to walk within the neighbourhood map provided. The results have been applied to the neighbourhood plan with green point for safe places and red one defining fearsome places to walk (Figure 7 and 8).

A spectral color from red to blue is used for visualization where the blue color shows the lowest value, and the red color represents the highest value.

The integration measure of an axial line (Figure3 and 4) is defined as the reciprocal of the sum of the least path from the root axial line to all others; the connectivity (Figure 5) refers to the number of the lines directly connected with the given line; the choice measure (Figure 6) is defined as the number of shortest-paths, which contain the root axial line dividing the number of all shortest-paths (Hillier and Iida, 2005).

Result

Correlation between Questionnaire Results and Accessibility Measures

Correlations between axial line measures and questionnaire outcome are calculated for finding the relationship between spatial configuration and pedestrian fear of crime.

Table 1. Correlation between accessibility measures and questionnaire results (Green point).

	Green point on the questionnary result		
	R	R square	P-value
Global integration value	0.702***	0.493	0.0000
Local inegartion value	0.648***	0.420	0.0000
Level of Connectivity	0.795***	0.633	0.0000
Choice value	0.890***	0.792	0.0000

*** = p< 0.001, ** = p< 0.010, * = p< 0.050.

The results are used to identify which variables of urban configuration effect on fear of crime. At the end, a model is proposed for walkable urban space.

The relationship between choice value and safe space of urban street (green point on the questionnaires) shows a highly significant coefficient of correlation (r=0.890, p < 0.001) in comparison with other accessibility measures.

Level of connectivity (r= 0.795, p < 0.001) reveals a significant coefficient of correlation with safe space that follows by global integration value (r= 0.702, p < 0.001), local integration value (r=0.648, p < 0.001) respectively (see Table 1). Due to positive correlation among these variables, it can be concluded that accessibility measures directly proportionate to perceived safety by pedestrian in urban street spaces.

Table 2. Correlation between accessibility measures and questionnaire results (Red point).

	Red point on the questionnary result		
	R	R square	P-value
Global integration value	-0.699***	0.489	0.0000
Local inegartion value	-0.598***	0.358	0.0003
Level of Connectivity	-0.406*	0.165	0.0231
Choice value	-0.322	0.103	0.070

*** = p< 0.001, ** = p< 0.010, * = p< 0.050.

Furthermore, the relationship between global integration value and fearsome space in the urban street (red point on the questionnaires) shows a highly significant coefficient of correlation (r=0.699, p < 0.0001) (see Table 2).

In addition, the local integration value has the significant correlation with fearsome spaces. Due to negative correlation between these variables, it can be concluded that integration value inversely proportionate to fear of crime in urban street spaces.

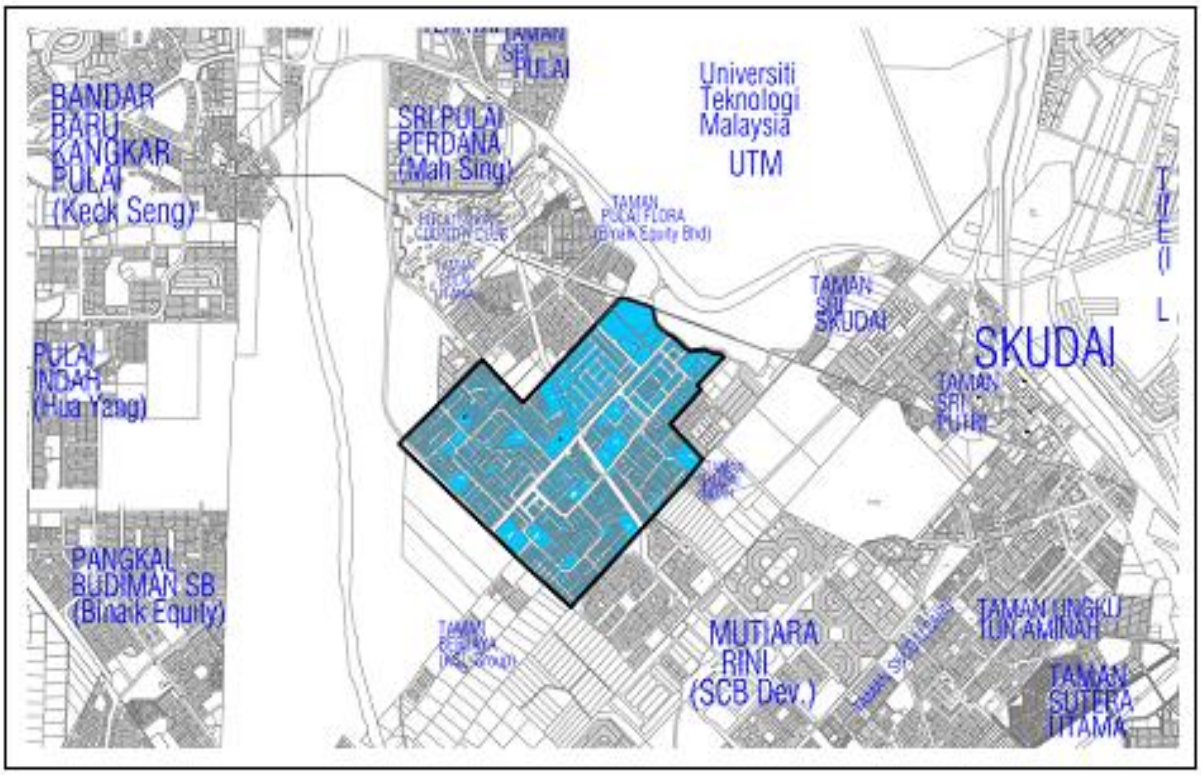

Fig. 1. Mixed-use neighbourhoods are predominantly residential neighborhoods that also include work, retail, cultural, and/or light industrial uses.

Discussion

The research findings show that the lack of access to some points within the neighbourhood creates defenseless spaces that lead to fear of crime. The results demonstrate that the spaces with high integration values have the least amount of fear but to have a safe walkable space is required to consider the level of connectivity and choice value as well as integration values in planning and designing the urban street networks.

Establishing safety and reducing the fear of crime need proper access in order to strengthen the social supervision, i.e., natural surveillance.

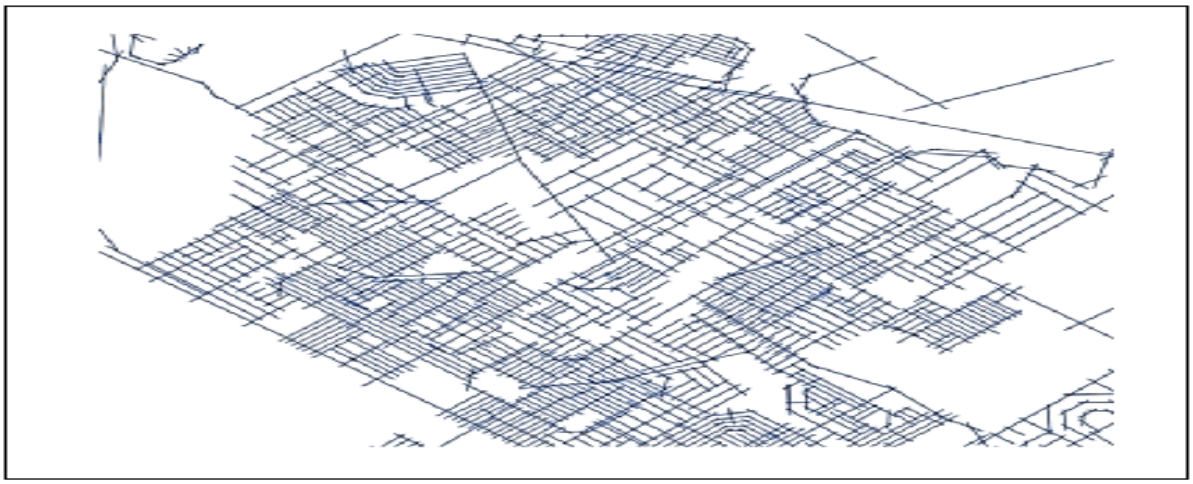

Fig. 2. Drawing axial model of Taman Universiti mixed land use neighbourhood in AutoCAD in order to export to Depthmap software.

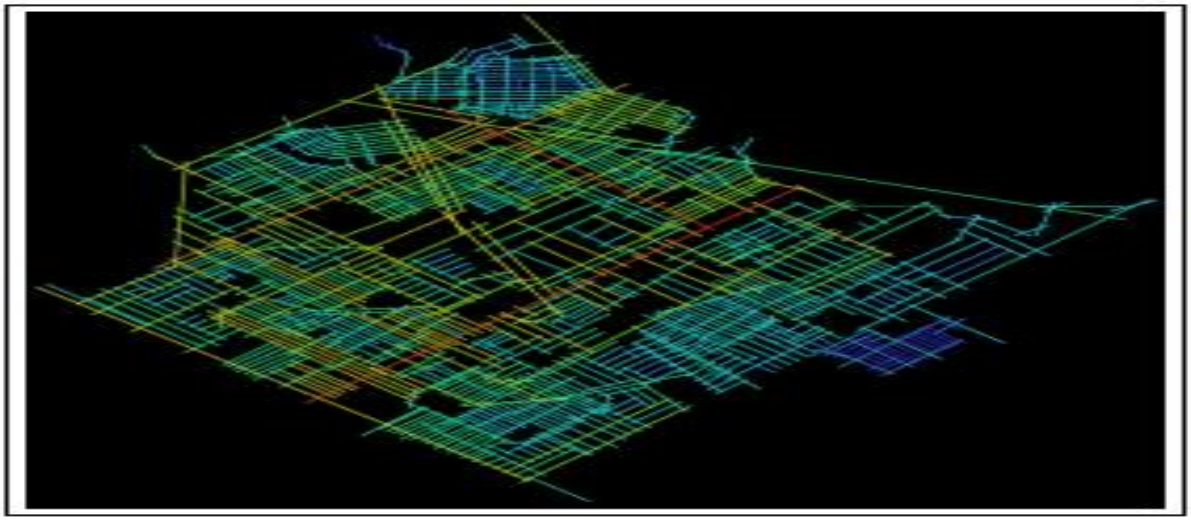

Fig. 3. Global integration value based on Axial line model of street.

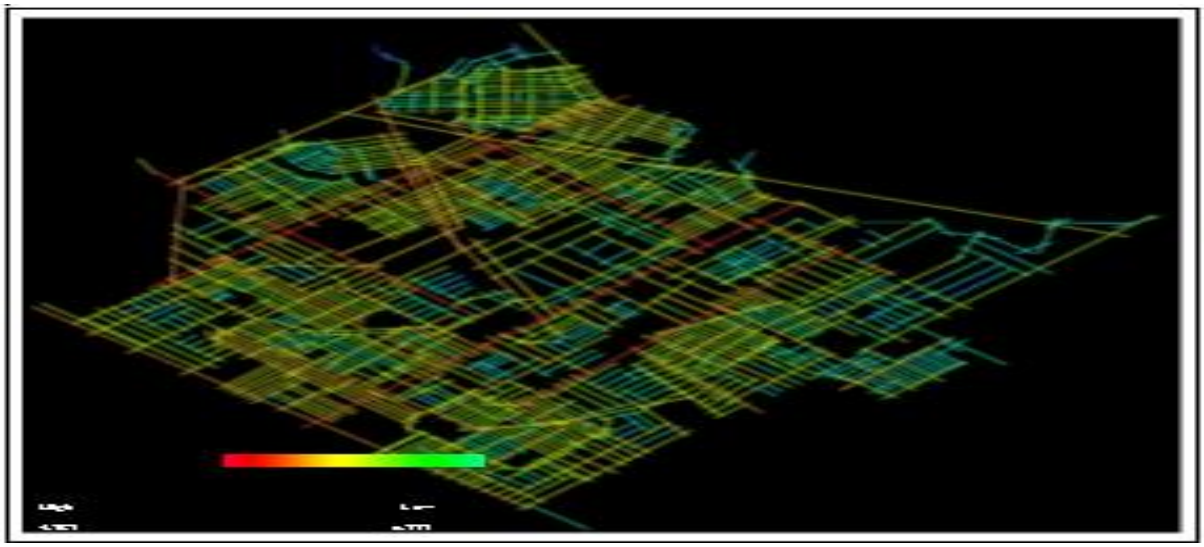

Fig. 4. Local integration value based on axial line model of street.

This approach confirms Jacobs' view that the circulation of people and appreciation of public spaces are crucial elements to the urban vitality and that natural surveillance is a good deterrent to criminal activity.

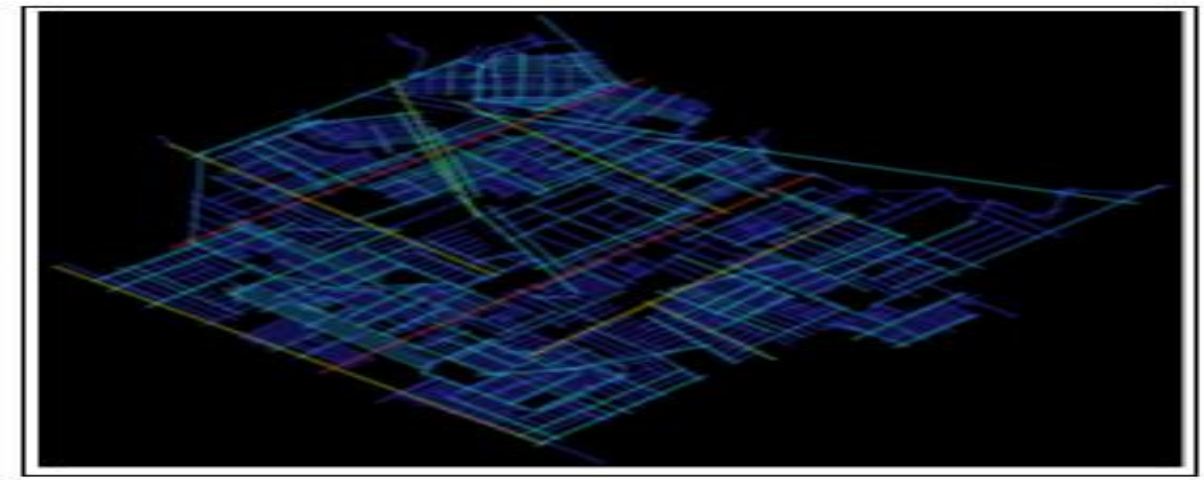

Fig. 5. Level of connectivity based on axial line model of street.

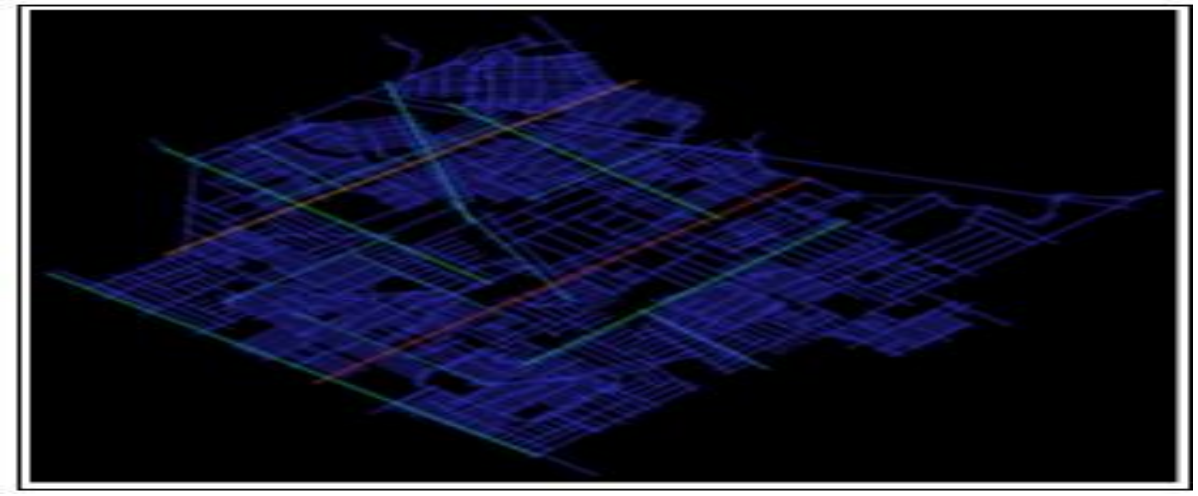

Fig. 6. Choice value based on axial line model of street.

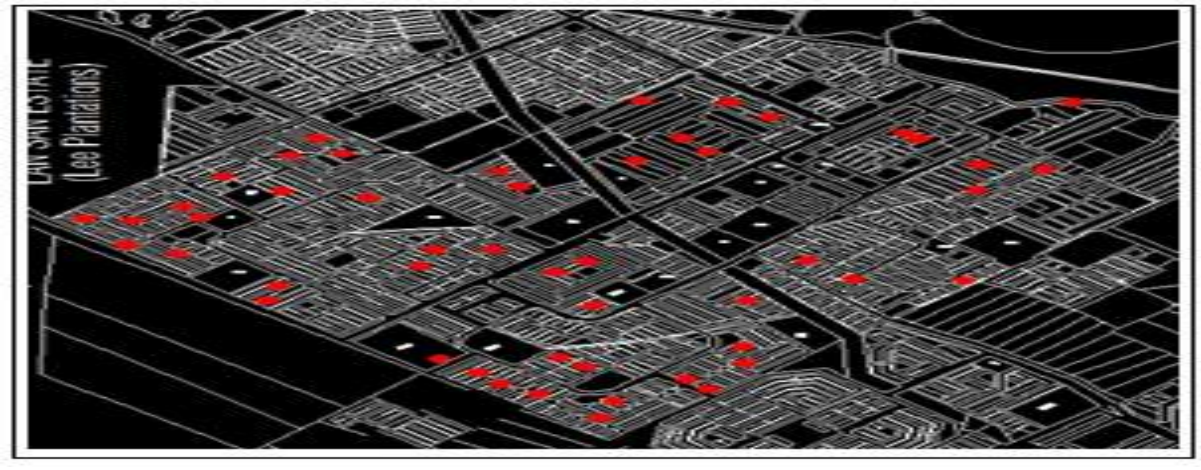

Fig. 7. The result of questionnaires that have been applied on the neibourhood plan (fearsome spcae).

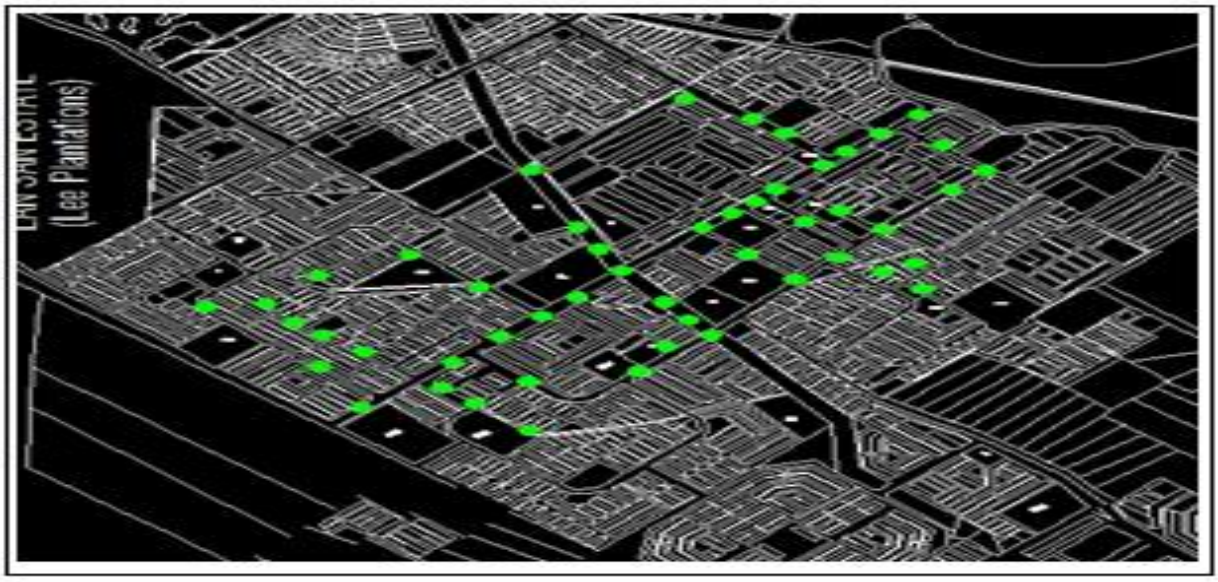

Fig. 8. The result of questionnaires that have been applied on the neibourhood plan (safe space).

Conclusion

The research findings show that the lack of access to some points within the neighbourhood has some influence on social problem and create unsafe spaces that lead to fear of crime.

The results showed that the fear of crime is a consequence of spatial separation. Therefore, reducing the fear of crime and establishing safety require appropriate access that makes a safe walkable urban street.

Acknowledgements:

Special thanks to Department of Architecture, FAB, Universiti Teknologi Malaysia for its cooperation in this research.

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