Neighborhood Geographic Information System to prevent home robbery

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Abstract. The purpose of this study is to apply a geographic information system to analyse the vulnerability of home robbery in neighbourhoods. To support the research, we use the Scoring Method with a Crime Prevention Through Environmental Design using the Geographic Information System. The results showed that the Geographic Information System in the neighbourhoods could visualise the vulnerability, based on the analysis conducted, seven residential have the potential for home robbery because based on the Vulnerability analysis, the seven residential belong to the category of vulnerable categories (categories 3). Based on these results, the information from this study can be used as a reference and study material in maintaining security in neighbourhoods.

1. Introduction
The crime rate in Indonesia continues to increase every year, based on Kholil, crime occurs every 1 minute 36 seconds [1]. National social-economy of disorder leads to a nominal of crime [2]. The data is proportional to the level of crime, especially in residential areas. Residential robbery can occur due to several reasons; besides the opportunity, environmental conditions also affect the level of risk of crime. According to Cahyaningtyas, environmental constraints can affect human behaviour and its users; crime behaviour is one example [3].

To minimise the potential for the occurrence of residential robbery, a study of environmental conditions is needed. One tool to assess environmental conditions is to use a GIS device. The potential for crime in the predicted area using the Geography Information System. GIS Application for the crime was developed around the 1990s [4], GIS tools were used to visualise crime pattern in an area and analyse the spread of crime. Development of GIS analysis using Multi-Criteria Decision Analysis for vulnerability analysis by the show that GIS could analyse and predict the potential of crime act like murder, thief, etc [2].

Therefore, the study of vulnerability in neighbourhood scale for a specific kind of crime like residential robbery has not been studied. The purpose of this paper is to analyse and visualise vulnerability of residential robbery in neighbourhood residential. To analyse, GIS is used to storing spatial data, attribute data, and analyzing areas makes residential robbery residential can be displayed [5]. In this research, a map of the scale was carried out for the neighbourhood scale.
2. Method
The Location of this research is in Puri Cipageran Indah Residence 1 RT 04/26 Cimahi contained 40 residential to analyse. This research used Quantitative Research and applied Multi-Criteria Decision Analysis then analysed using Geographic Information System tools. Multi-Criteria Decision Analysis is a process that evaluates various criteria to reach a specific objective which allows taking a decision [5]. The MCDA process includes the following steps:

2.1. Objective definition
The objective of this research is analysing and showing the vulnerability of residential robbery. To analyse it, CPTED approached is used to define the criteria.

2.2. Criteria definition
The Crime Prevention Through Environmental Design (CPTED) Approach was used to define the criteria. The approach that developed by C Ray Jeffery on Cahyaningtyas [3]. The CPTED approach is an effective and appropriate design of the built environment that aims to reduce fear and incidents of crime [6]. This approach is divided into six other factors:

- natural surveillance
- access control
- territoriality
- maintenance
- activity support
- target hardening

The CPTED approach is then described using a Geographic Information System. According to Groff, the use of GIS can describe the spatial characteristics of a region [4]. Description method uses Multi-Criteria Decision Analysis, MCDA is a decision-making technique which combining many attributes to give an alternative solution [7]. Combining GIS and MCDA creates a useful tool for spatial analysis [2,5].

Each of the CPTED criteria then translated into environment criteria. Table 1 shows the GIS attribute for CPTED approach. Every criteria are divided into classes. Each class then described and inputted from data on the field; the data then analyse using MCDA method.

Table 1. MCDA GIS Attribute for CPTED approach.

| No | CPTED                | Multi-Criteria Analysis   | Class                                |
|----|----------------------|---------------------------|--------------------------------------|
| 1  | Natural Surveillance | Position                  | Corner, junction, between             |
| 2  | Access Control       | Road Class                | A public road, local road             |
| 3  | Territoriality       | Physical Condition        | Good condition, bad condition        |
| 4  | Maintenance          | History of Robbery        | Been robbed, never been robbed        |
| 5  | Activity Support     | Floor                     | Number of residential floors         |
| 6  | Target Hardening     | Distance from Portal      | Direct distance                       |

2.2.1. Proposal for factors weighting. The parameter then transferred into quantitative data then analyzed using the scoring method and make a classification based on the total value of scoring value.

3. Result and discussion
Scoring results are divided into three levels of vulnerability, including low, medium and high vulnerability. This level of a vulnerability is defined using a qualitative approach. Based on the results of the scoring conducted, there were 47 residential residential within the administrative area. The distribution of residential is shown in figure 1.
Figure 1. Administrative map.

The results of the analysis with GIS show the distribution of areas that have a level of vulnerability, the distribution of the level of vulnerability in the figure 2.

Figure 2. Vulnerability map.

According to the table 2, there are seven residential properties that have a high level of vulnerability, 39 residential properties have a moderate level of vulnerability, and one residential property that has a low level of
vulnerability. High levels of vulnerability are generally influenced by the position of the residential on the road at the end. This is influenced by the position far from the portal, and the position is difficult to be controlled by the surrounding environment.

Table 2. Vulnerability percentage.

| Prone Status | Total | Percentage |
|--------------|-------|------------|
| Low          | 1     | 2%         |
| Medium       | 39    | 83%        |
| High         | 7     | 15%        |

4. Conclusion
The use of GIS to prevent the occurrence of residential robbery can provide a sense of caution to the owners. Analysis using MDCA method shows that CPTED approach could be translated into quantity criteria and analysis using scoring technique. In this study it was found that by using GIS, there were 7 residential (15%) that had a high level of vulnerability. 39 residences (83%) have moderate vulnerability, and 1 residential (2%) which has a low level of vulnerability.

References
[1] Kholil K 2017 Pemanfaatan Sistem Informasi Geografis (SIG) dalam Aplikasi Pelaporan Dan Pelacakan Kejahatan Berbasis Android J. Teknol Inf Dan Komun. 6(1) 51
[2] Achu A L and Rose R S 2016 GIS Analysis of Crime Incidence and Spatial Variation in Thiruvananthapuram City International Journal of Remote Sensing Applications 6 1–7
[3] Cahyaningtyas M A, Tazkia A M, Fitriani T, Ekomadyo A S and Aulia N Telaah Parameter Desain Untuk Kawasan Rawan Kriminalitas Di Kampung Kota Studi Kasus: RW 05 Kebon Bibit, Bandung 9
[4] Groff E R and Vigne N G L Submitted by the National Institute of Justice U.S. Department of Justice, Crime Mapping Research Center 12
[5] Subhashini R and Milani V 2015 Implementing Geographical Information System to Provide Evident Support for Crime Analysis Procedia Comput Sci. 48 537–40
[6] Md Sakip S R and Abdullah A 2017 View of CPTED Measures in a Gated Residential Area Asian J Environmen-Behav Stud 2(4) 33–42
[7] Mokarram M and Hojati M 2016 Using ordered weight averaging (OWA) for multicriteria soil fertility evaluation by GIS (case study: southeast Iran) Solid Earth Discuss. 15 1–28