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SPATIAL MODEL OF GRADUATE STUDENTS TRAVEL IN MAKASSAR CITY

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ABSTRACT

Traffic congestion problems in the area of education is a problem that must be addressed, especially in the city of Makassar. it happens due to the large volume of traffic around the area of education that lead to urban transportation problems such as traffic congestion, air pollution and noise pollution .. This study aimed to analyze the social and economic characteristics of the trip students into public universities in Makassar. The method used is the spatial analysis and determine the pattern of residential students using open source QGIS program. The analysis showed generally college students to use motorcycles, and student residential patterns are clusters.

*Keywords***:** *Graduate Student, QGIS, Spatial analysis, Pattern, cluster, Makassar*

I.   INTRODUCTION

Generally people travel from one place to another to consume a certain service & facilities as a part of his daily life. These service & facilities are often treated as opportunities that are accessible to a person physically. Considering travel as a derived demand, transportation researchers have recognized that the spatial and temporal distribution of activities can determine where and when people travel (Damn, 1983).

In the context of a trip to campus, especially in developing countries such as Indonesia, a trip to campus activities contributed greatly to the transportation problems such as traffic congestion, air pollution and noise pollution. This is a concern for urban transport planners in terms of reducing the impact caused by traveling to campus. Trip generation and trip attraction to campus cause problems in the urban transport system especially in Makassar City such as traffic congestion and delays at intersections on the streets around the campus. And as a result it causes impacts derivative form of increased travel costs and increasing the amount of vehicle emissions in the form of air pollution and rising noise levels.

So, it is very important to consider the location of home constraint of an individual to access the opportunities in case of measuring accessibility. Individuals need to perform various activities to maintain existence in society. Although certain activities may occur simultaneously, more often they exclude each other and are executed in a sequence in which each activity has to be carried out within a given duration, at a certain place, and in presence of other individuals. Because spatial movement consumes time and due to the specific time budge of the individual, activities which have fixed execution time or locations limit him from physically participating in events elsewhere. Therefore, a better grasp of spatial and temporal characteristics of human activities and interactions can help researchers gain a better understanding of the land use and thus accessibility to urban opportunities.

Another thing many colleges and universities, both public and private schools in the city of Makassar, cause of choice in education, especially from the eastern region of Indonesia. This has become one of the attractions to stay in urban areas especially in Makassar.

A.   What is GIS?

There are several definitions of GIS (Geographic Information Systems), which is not simply a program. In general, GIS are systems that allow for the use of geographic information (data have spatial coordinates). In particular, GIS allow for the view, query, calculation and analysis of spatial data, which are mainly distinguished in raster or vector data structures. Vector is made of objects that can be points, lines or polygons, and each object can have one ore more attribute values; a raster is a grid (or image) where each cell has an attribute value (Fisher and Unwin, 2005). Several GIS applications use raster images that are derived from remote sensing.

GIS (Geographic Information System) is a powerful tool that allows to perform spatial analysis and graphic representation of large amounts of data. Analysis of demand for transport and transport planning is a process of intensive data processing. Understanding the needs of the transport depends on the analysis of travel behavior, which in turn depends on several factors among which are the socio-demographic characteristics, the characteristics of land use and transport system itself. This paper explores how GIS can be used to analyze a sample that represents the population of spatial data and temporal data varied.

B. Spatial Analysis

Spatial analysis is a set of techniques for analyzing spatial data. The result of spatial analysis depends on the location of the object being analyzed. Software which implements spatial analysis techniques require access to both the location of objects and attributes. The main spatial analysis are described below

a. Measurement.
b. Query.
c. Reclassification
d. Neighborhood.
e. Interpolation.
f. Vector Overlay.
g. Raster Overlay
h. Implementation Overlay.
i. Classification,
j. Network
k. Buffering.
l. 3 Dimensional Analysis

II. STUDY AREA

Makassar City is located in South Sulawesi province and the largest city in eastern Indonesia. Makassar is the center of commerce, industry and education. Makassar is the capital of South Sulawesi province, which is located in the southern part of Sulawesi Island, formerly called Ujung Pandang, which lies between 119: 18'38 "to 119: 32'31" east longitude and between 5: 30'30 "to 5 : 14'49 "South Latitude. The area of is 175,77 square km which include 14 district. This study was conducted at two universities, namely the Hasanuddin University and Makassar University (there are two campuses that UNM Pinisi and UNM parangtambung). (fig.1.)

Figure 1: Location of the study area map

III. AIMS AND OBJECTIVES

This study aims to analyze the characteristics of college students traveling to public universities and spatial analysis of student residential location in the city of Makassar

 i. Analyzing the characteristics of a student trip to campus at public universities based on individual attributes in Makassar.
 ii. perform spatial analysis based on the location of residence of students of state universities in Makassar city

IV. DATA AND METHODOLOGY

The whole methodology of this research is focused on descriptive spatial analysis and application of GIS for spatial analysis of student residential location. The main steps involved in the methodology is as follows:

 i. vector map creation of student residential location
 ii. geo-referencing
 iii. Extraction of study area
 iv. Preparation of various vector layers.

In this study conducted a survey by questionnaire and GPS surveying instruments.

The number of samples taken in this study were 1687 samples as presented in Table 3.1

Tabel 1. number of samples

state University	population	Sample
Hasanuddin University	17550	1019
Makassar State University	9159	453
		215
	Total	1687

V. SOCIO-ECONOMIC CHARACTERISTICS

A. social and economic characteristics variables

Socio-demographic characteristics of students traveling from recident to campus became variable research covering the campus location of Unhas, UNM campus Pinisi and UNM Campus Parangtambung among others:

i. Location of residence

Student residential types are classified into four categories which consists of their own homes, family homes, Dormitory and hostel. The results of the analysis of student residential varied as shown in figure 2 and figure 2.
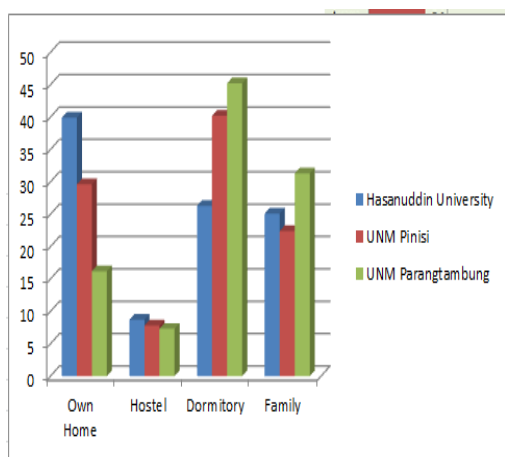
Figure 2: The percentage is based on the type of student residential
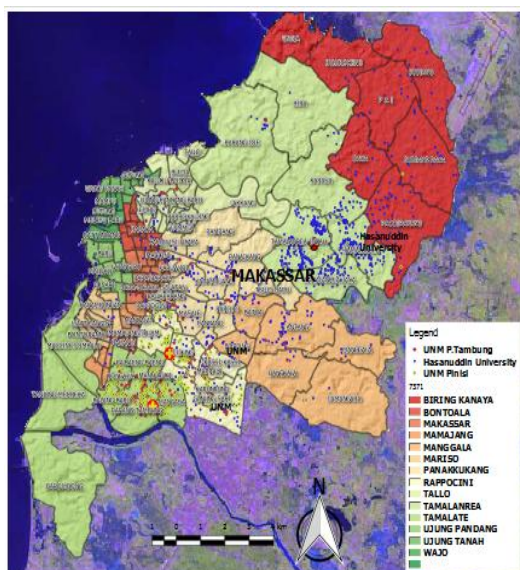
Figure 3. :Graduate student residential location map

ii. Vehicle Ownership motorcycle

Percentage of motorcycle ownership for students Unhas by 53% (UNHAS) and UNM students and 63% (UNM). The percentage of ownership in the motorcycle used perform learning and other activities of the State University Makassar.Dari these results it can be concluded that the vehicle ownership student public university in the city of Makassar is a motor bike by 58.3% and students who do not have a vehicle ranges from 30, 8%. And four-wheeled vehicles ranging from 11.0%.
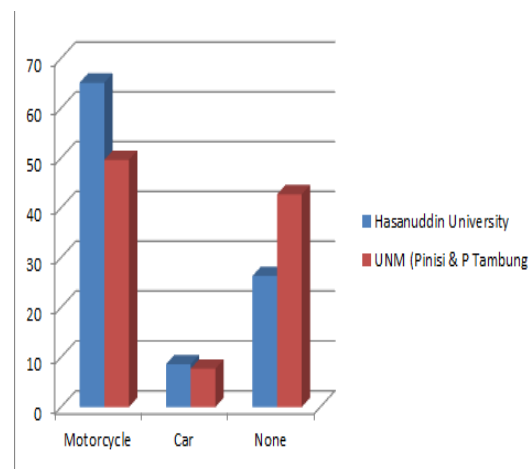

Figure 4: percentage of vehicle ownership

B. Travel characteristics

Characteristic variables trip students into public universities in Makassar is direct distance. The choice of location residential particular student boarding house election closely related to the distance, either directly or within short distances. Direct distance between the campus student residential can be calculated and mapped with qgs. The percentage of direct distance between residential students and campus with the greatest is a category one (0-2 km) of 40.8%, and the smallest percentage are six categories (> 10 km) with a value of 0.4%. This indicates that residential location Unhas's students and UNM's student located around the campus (figure 5) shown in figure 5.,6 dan 7.
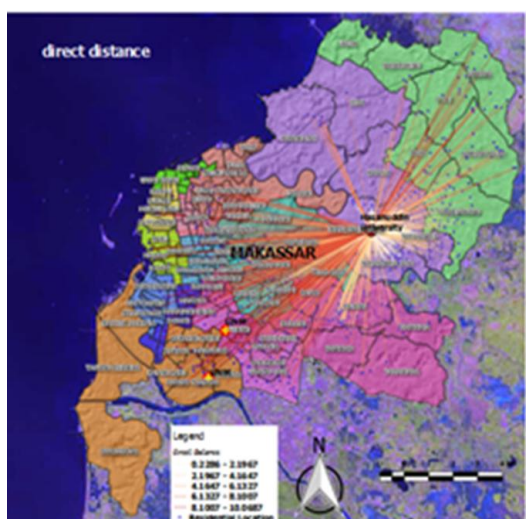
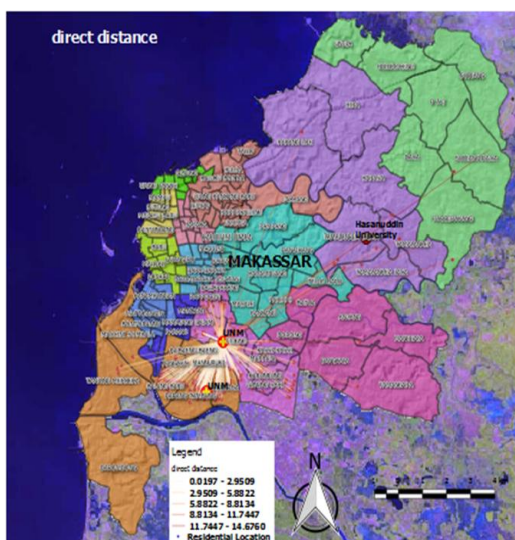**Figure 5:** Direct Distance Home-Campus Hasanuddin University.

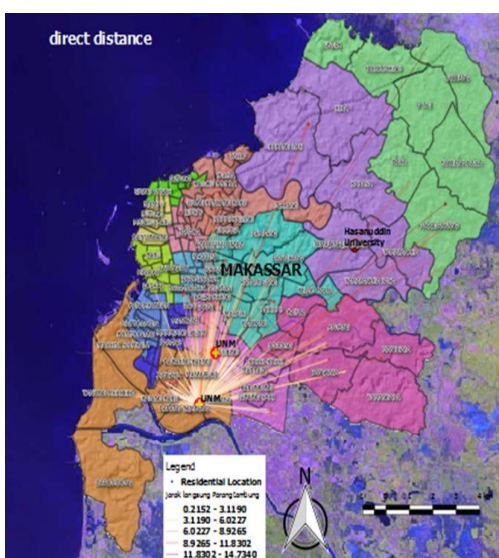

Figure 6: Direct Distance Home-UNM Cmpus

Figure 7: Direct Distance Home-UNM Cmpus

VI. SPATIAL ANALYSIS.
A. Standard deviation Distance (SDD)

Spatial analysis standard deviation distance is a way to measure the spatial patterns in the distribution of a group of data points and generate a single feature that represents the dispersion features around the center point (mean or median). Values that produced a polygon with a certain radius, so that the results of the analysis in the form of new features that describe the cohesiveness of data points and can be represented on the map by drawing a circle with the same radius. Standard Distance tool creates a new feature class containing a circle polygon centered on the mean center (one center and one loop per case, if the field is specified cases). Each polygon drawn a circle with a radius equal to the standard deviation distance (SDD).

Student residential location (Unhas, UNM) has been analyzed and mapped using the standard deviation distance (SDD) as described in Figure 8.
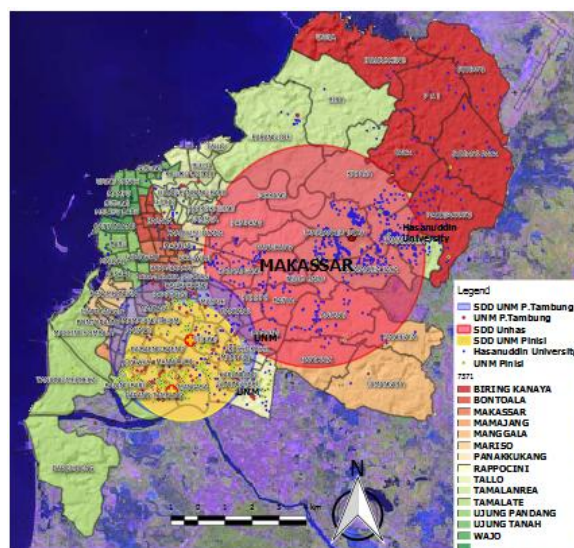

Figure 7: Standard Deviation Distance (SDD) for student residential location Map (Unhas, UNM Pinisi and UNM P.Tambung)

B. Standard deviation Distance elliptical (SDDE)

Spatial Analysis Standard Deviation Distance elliptical is a common way to measure trends / tendency of the distribution pattern of data points or regions by calculating the distance of standard separately in the direction axis x and y axis directions. The second step determines the axis of the ellipse includes the distribution features. deviational ellipse referred to as a standard, since the method of calculating the standard deviation of the coordinate x- and y- coordinates of the center / median and, the method for determining the axis of the ellipse. Elliptical shape allows it to be able to explain whether the distribution patterns of

elongated features and therefore has a particular orientation.

Methods Directional Distribution (Standard Deviational Ellipse) is a tool to determine the pattern of the new features in the form of an ellipse polygon centered on the center of the average for all features. The attribute values for these ellipse polygons output includes two standard distances (long and short axis).
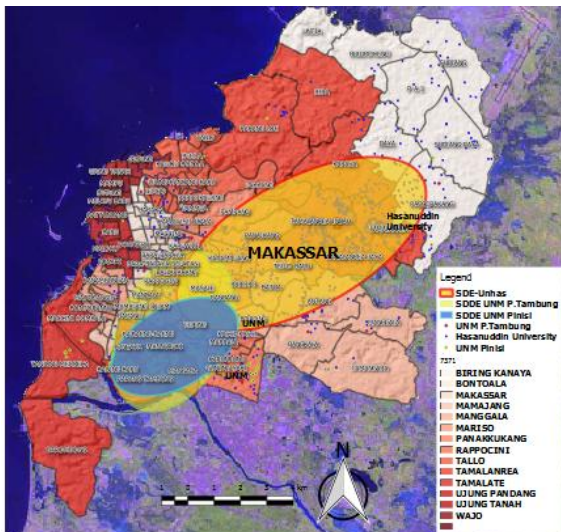

Figure 8: Standard Deviation Distance elliptical (SDDE) for student residential location Map (Unhas, UNM Pinisi and UNM P.Tambung)

C. Spatial statistical method with Heat map

Usefulness of Spatial statistical method according to Scott (2008) is a spatial statistical analysis has three purposes, namely:

▪ Measurement of a distribution of spatial (A measure of what's going on spatially).
▪ Identify the characteristics of a distribution (Identifying characteristics of a distribution)
▪ Quantification of geographic patterns (quantifying geographic pattern).
• Density Estimation or more appropriately termed as the estimated probability density estimation on the surface that typology point, by using kernel methods. Each kernel estimate every point in a grid that overlap the distribution pattern point.
• Hot Spot Detection analysis, the method used is the quadrant count, to present a grouping by comparing the number of occurrences (point) with a random area. Point analyzed are divided into groups according to the hierarchy of densities by using more than a circle ellipse. A heat map is a two-dimensional representation of the data in which the values represented by the color. A map Heat map gives a visual summary directly from the existing information.

• Heat map more complicated map allows viewers to understand more easily than a set of complex data. There are many ways to ask questions heat map, but all have one goal and one thing in common, namely by using gradation colors to communicate about the relationship between the values of the data in the form of a map heat map which would be much more difficult to understand when presented in numerical form in the data table.

The result of spatial analysis methods have been performed on the heat map the location residential students (Unhas, UNM and UNM Pinisi Parangtambung) in order to determine the most dense residential location as described in the figure 9,10 and 11.
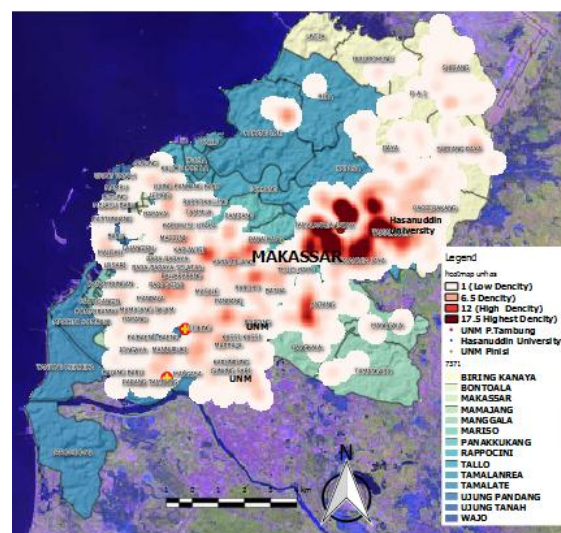

Figure 9: Spatial Analysis with Featmap Method student residential location Map (Unhas)
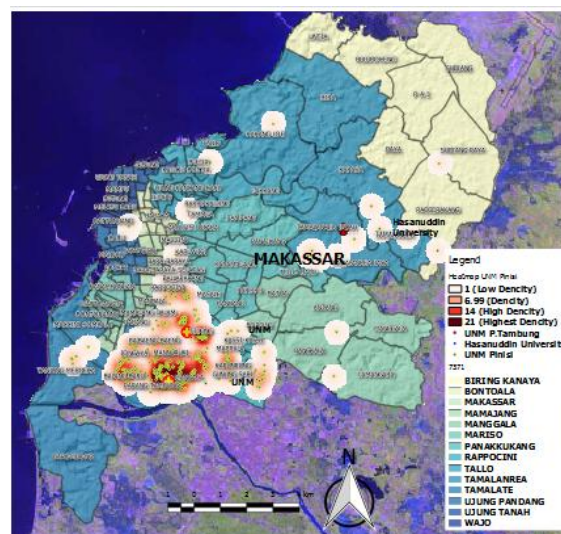

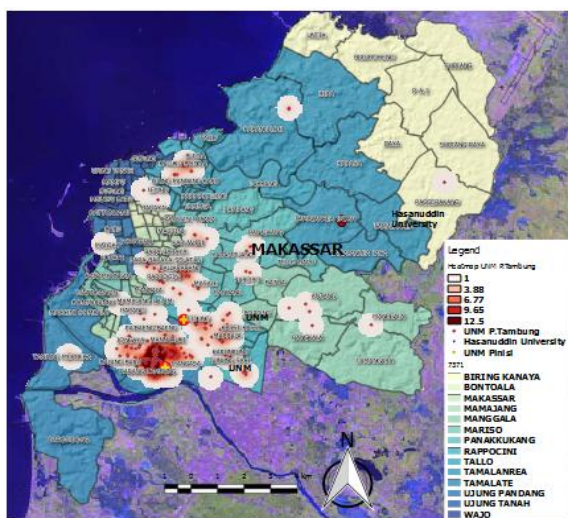**Figure 10:** Spatial Analysis with Heat map Method for student residential location Map (UNM Pinisi)

Figure 11: Spatial Analysis with Featmap Method for student residential location Map (UNM Pinisi)

C. Spatial statistical method with Grid

A grid density is a way to visualize and analyze the data point to change the points to a grid cell. Each grid cell is generated by the value determined by the density of the closest points, optional weighting each point using the weight values.

Density grid useful for crime mapping data to indicate the location of hot spots, mapping vehicle miles traveled to areas where congestion and air pollution are higher, and analyze the pattern of population density in urban areas.

The results of the mapping grid spatial analysis methods (1000 m x 1000 m) have been conducted to determine the location of residential students (Unhas, UNM and UNM Pinisi Parangtambung) based on the density level as described in Figure 12, 13,14
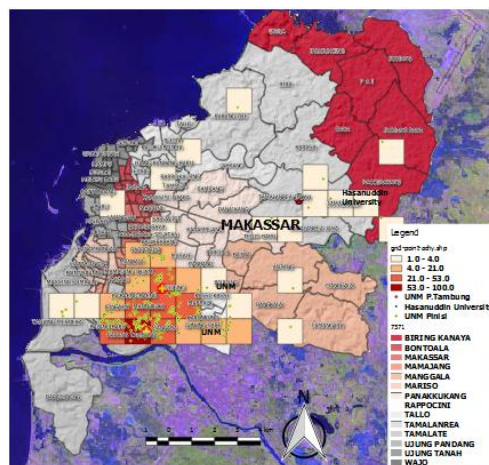

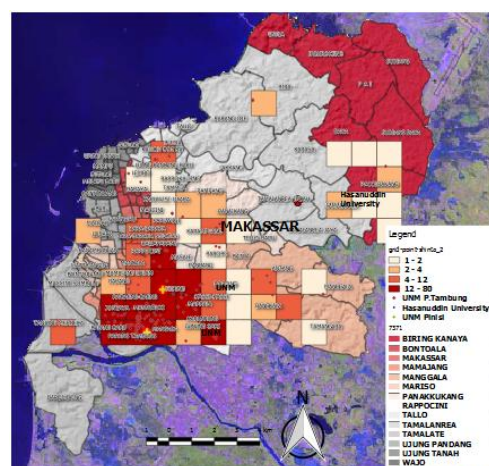**Figure 12:** Spatial Analysis with Grid Method for student residential location Map (Unhas)

Figure 12: Spatial Analysis with Grid Method for student residential location Map (UNM Pinisi)

Figure 13: Spatial Analysis with Heat map Method student residential location Map (UNM Parangtambung)
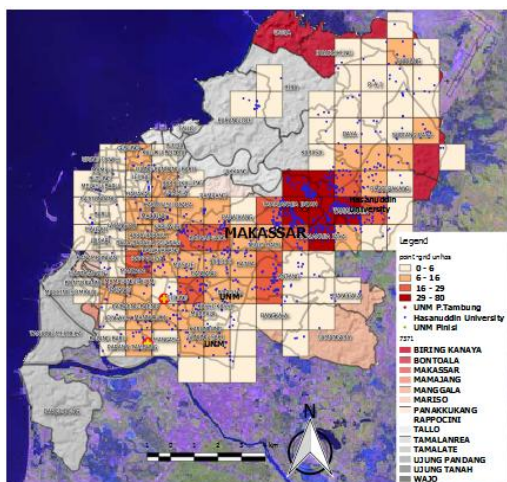
D. Analysis spatial and Test point of Patterns Spatial Clustering

Realization of points spatially manifested by a pattern such points in space. A pattern of points in space, in principle, there are three kinds, namely spatial random pattern of dots, patterns of spatial points (student residential location) on a regular basis as well as the spatial pattern of points in groups. Spatial pattern of points caused by process group (factor of social and economic factors) that drive these points move to approach certain sources (campus).

Many other examples that show the spatial distribution point that is the group. Therefore, it is important suspect form of spatial distribution point. whether or not the group is. There are two strategies for detecting the spatial distribution point group that is suspected mass function of the point spread odds or determine the statistical count that indicates whether the spatial distribution point is the group or not.
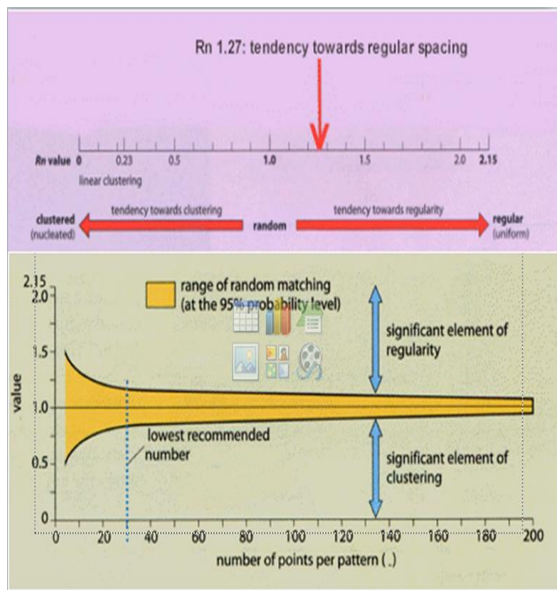
Figure 14 : Tendency toward regular spacing and number of point per pattern

Methods for analyzing student residential location patterns whether the data pattern of random, patterned uniform or patterned accumulate (claster) is to use a nearest neighbor analysis claster.Indeks (NNI) is an indicator for clustering, which is calculated by comparing the distribution of observed events to the expected random distribution of these values. Figure 15 describes three types of patterns that are likely to happen in a student residential.
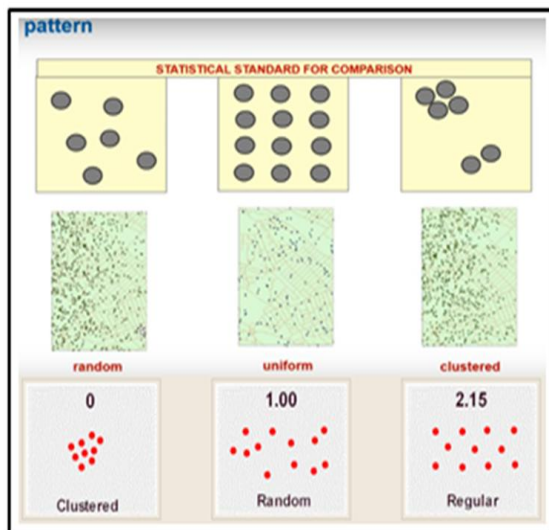

Figure 15 : Comparison statitistic standard for pattern

From the survey data, analyzed by nearest neighbor analysis method index (NNI) on residential location of graduate students (Unhas, UNM) with QGIS program, as shown in Figure 16. and the results are tabulated with variable testing with the nearest neighbor index (NNI) asin table 2.
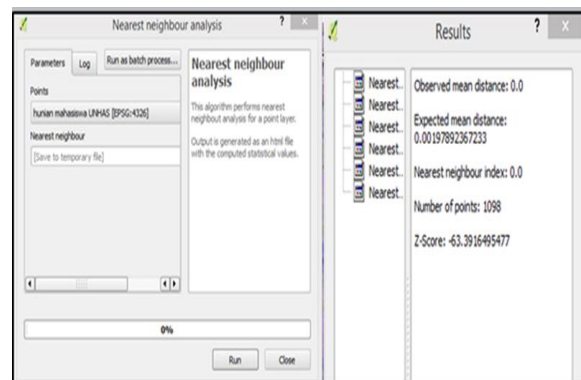

Figure 16 : Spatial analysis methods with nearest neighbor index in QGIS program

According to analysis by the method of the nearest neighbor index (NNI) it could be concluded that the trend of the three locations the student residential (Unhas, UNM Pinisi   and UNM Parangtambung) are a cluster pattern and it is influenced by social and economic factors that lead to the location of the campus. The results of the analysis with the nearest neighbor index method is presented in table 2.

NO	Kampus	Observed mean distance:	Expected mean distance:	Nearest neighbour index:	Number of points:	Z-Score:	Patternt
1	Unhas	0	0	0	1098	-63.39	Claster
2	UNM Pinisi	0	0.0027	0	451	-40.63	Claster
3	UNM Parangtambung	0.0012	0.0036	0.34	230	-19.14	Claster

Table 2: Results of spatial analysis method of the nearest neighbor index (NNI) for graduate students (Unhas,UNM Pinisi and UNM Parangtambung)

VII. CONCLUSION

Makassar City is the center of development and education development in eastern Indonesia, and the condition is still lagging compared with the western part of Indonesia. Because Makassar is a center of growth, the effects are the problems of transportation in the city of Makassar, especially at peak hours such as the problems of congestion and air pollution and noise pollution, It also occurs in the vicinity of the campus. This study aims to understand the relationship characteristics of college students traveling to campus and with the selection of residential locations. The method used is the spatial analysis with the help of open source QGIS program to understand the density of residential location patterns of residential students and college students.

From the analysis it can be concluded that college students in the city of Makassar in general use motorcycles and residential patterns are students around campus and the residential nature cluster pattern. From the results, it made reference in managing land use and sustainable transportation in the city of Makassar.

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