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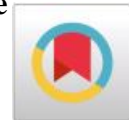
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GEOGRAPHIC INFORMATION SYSTEM OF HIGHER EDUCATION MAPPING IN BALI ISLAND USING ARCVIEW

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Abstract:

Higher Education is the level of higher education or further education after a high school education or equivalent. Based on the observations of researchers in Bali Island, especially in the city of Denpasar is very growing growth of universities by providing a variety of courses so that information about the college is not maximally known by the general public and high school alumni / equivalent in particular who want to continue to higher education level. To provide more interactive and effective information then built the application of geographic information system of the spread of universities on the island of Bali by using Arcview GIS as its tools. The data needed on this system is spatial data and non spatial data. Spatial data is a data type of vector that has the characteristics of point, line and polygon. Point is used to represent cities and colleges, lines used to represent roads and polygons are used to represent areas of the district locations of the college. The non-spatial data is the attribute data describing the college. Spatial data and non-spatial data intergrated are implemented in ArcView in the form of digital maps. The process undertaken in this study is the grouping of universities by type of universities, institutes, high schools, polytechnics and academies. Grouping by type of college in each regency / municipality on the island of Bali with the aim to facilitate in obtaining information of colleges in each kabupeten so that people can calculate the distance of residence with the desired college. The result of this research is application of university dissemination in each regency / municipality and application of university deployment in Bali Island by using ArcView GIS (Geographic Information Siystem) software.

Keywords: Geographic Information System; Higher Education Mapping; Digital Maps.

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1. Introduction

Higher education is a continuation of secondary education held to prepare learners to become members of the community who have academic and professional skills that can apply, develop and create science, technology and art [4]. At this time the development of universities in Bali is very

rapid, along with the increasing needs in the world of work that requires experts in their respective fields.

The community in general and the students who graduated from high school / vocational school / equivalent in particular, desperately need effective and efficient information in obtaining information about the university on the island of Bali and no doubt to place his choice in accordance with the interests and abilities in a particular field of knowledge. Therefore, it is necessary to build an application of geographic information system of the spread of this college that can help the community or graduate high school students / vocational / equivalent who just completed their education and want to continue education to a higher level again.

Geographic Information Systems (GIS) can provide information effectively in determining universities based on the areas of knowledge that are in demand by the community. During this time the public difficulty in obtaining information because of the possibility of too many universities in Bali are scattered in some areas and the possible lack of socialization of each college about the program offered. Therefore, this system can be a decision-making system for the community in general and graduates of high school / vocational school / equivalent in particular, to determine the choice of universities in accordance with their interests.

2. Materials and Methods

Geographic Information System Concept
Geographic information system consists of three terms, namely system, information and geography. The system is a set of components or elements that are interconnected between components / elements to achieve goals. The concept of information is the result of data processing and geography is the study of the Earth's surface. The concept of geographic information system is a collection of components consisting of interacting with each other in data processing so as to produce geographical information that implementation in the form of digital maps. Geographic information systems can also be defined as an information system that can analyze, store, update, integrate and display all forms of information related to the earth's surface. The existence of an efficient geographic information system capable of managing data with complex and large-scale structures can assist in the decision-making process [16].

Spatial data is data that has geo reference references where various attribute data are located in various spatial units. Currently spatial data is becoming an important medium for sustainable natural resource development and management planning on continental, national, regional and local coverage. The utilization of spatial data is increasing after the existence of digital mapping technology and its utilization in Geographic Information System (GIS). Spatial data formats can be either vector (polygon, line, points) or raster. In this study using the vector format because the map is a thematic map [15].

Non-spatial data or attribute data is a type of data that represents descriptive aspects of the phenomenon being modeled, this descriptive aspect includes items or properties of the phenomenon concerned to the time dimension [15].

ArcView Concept

ArcView is one of the desktop Geographic Information System (GIS) software and mapping developed by ESRI (Environmental System Research Institute). With ArcView, users can have the ability to visualize, explore, answer queries (spatial and non spatial databases), analyze data geographically and so on. The capabilities of these ArcView SIG devices can generally be described below [15]:

1) Data exchange: reading and writing from and into other GIS software formats.
2) Perform statistical analysis and mathematical operations
3) Displays spatial data and attributes
4) Answering spatial queries as well as attributes
5) Perform basic GIS functions
6) Create thematic maps
7) Customize the application using the script language
8) Doing other special GIS functions

Mapping Concept

Map is a depiction of the surface of the earth that is projected onto a plane with a certain scale.
Map Making Functions and Purposes:

1) Shows the relative position or location on the face of the earth
2) Shows the size (width, distance) on the face of the earth
3) Describe the shape of the face of the earth
4) Presenting potential data of a region
5) Communication of space information
6) Save information
7) Assisting the job (road construction, navigation, planning)
8) Analysis of spatial data (volume calculation)

Types of maps by Data Type are Topographic Map, Thematic Map, based on the scale is Cadast Map (1: 100 to 1: 5.000), Large Scale Map (1: 5.000 - 1: 250,000), Medium Scale Map 1: 250.000 up to 1: 500.000), Small Scale Map (1: 500.000 - 1: 1.000.000), Geographic Scale Map (> 1: 1,000,000) [17].

Map components, Map Scale, Legend, Orientation, Symbols, Source and manufacture and Projection. Map analysis is an attempt to analyze the information displayed on the map. Examples include counting slopes, calculating volumes, determining patterns and drainage densities, analyzing vegetation patterns, analyzing patterns of settlement distribution. Map Interpretation is an effort to analyze the map associated with other sources of information, for a purpose. For example, if a region on the map has a rectangular drainage pattern, it can be predicted that the ground surface of the area is flat, and composed of soft rocky surfaces. Map Projection is an attempt to move parallel lines and meridians from the curved plane to the flat plane.

Higher Education Definition

Higher Education is a continuation of secondary education held to prepare learners to become members of the community who have academic and professional ability who can apply, develop and create science, technology and art [1].

Higher Education are educational units of higher education providers. Students are called college students, while college educators are called lecturers. By type, colleges are divided into two:

- State higher education are universities organized by the government.
- Private higher education are private universities. These education are managed by Private Legal Entities & under the coordination of Kopertis of each region.

According to the level of his position, private higher educationare divided into 3 statuses, namely:

1) Higher education with registered status are valid for a period of 5 years.
2) Higher education with a recognized status is valid for a period of 4 years.
3) Higher education with equal status shall be valid for a period of 3 years.

Higher education is education at a higher level than middle school education in education. Higher education objectives are:

1) Preparing learners to become members of the community who have academic and professional skills who can apply, develop and create science, technology and art.
2) Develop and disseminate science, technology and art as well as optimize its use to improve people's living standards and enrich national culture.

In Indonesia, higher education can take the form of academy, institute, polytechnic, college, and university. Higher education can provide academic, professional, and vocational education with diploma education programs (D1, D2, D3, D4), undergraduate (S1), master (S2), doctoral (S3), and specialist degrees. Universities, institutes, and colleges with doctoral programs are entitled to award honorary doctorates to honorable individuals with respect to outstanding services in the fields of science, technology, society, religion, culture or art. The name of a professor or professor is only used during the relevant work is still active as educators in college.

This research method consists of several stages:

1) Search data from internet
2) Observation of the location of Higher Education
3) Literature review
4) Data collection
5) Data analysis process (spatial data and non spatial data)
6) Analysis of non spatial data using ERD (Entity Relationship Diagram)
7) Layer identification process
8) Digitization process

3. Results and Discussions

Digitization is the process of drawing maps from manual to digital. Digitization process is by identifying the layer to be created. Layers are layers with the aim of grouping the same data so that it is easily manipulated. The first layer is a layer with polygon type feature to store spatial data of the islands of Bali (* shp). The second layer is the district / municipality layer and is equipped with the name of each region. The result of digitization can be seen in figure 1.
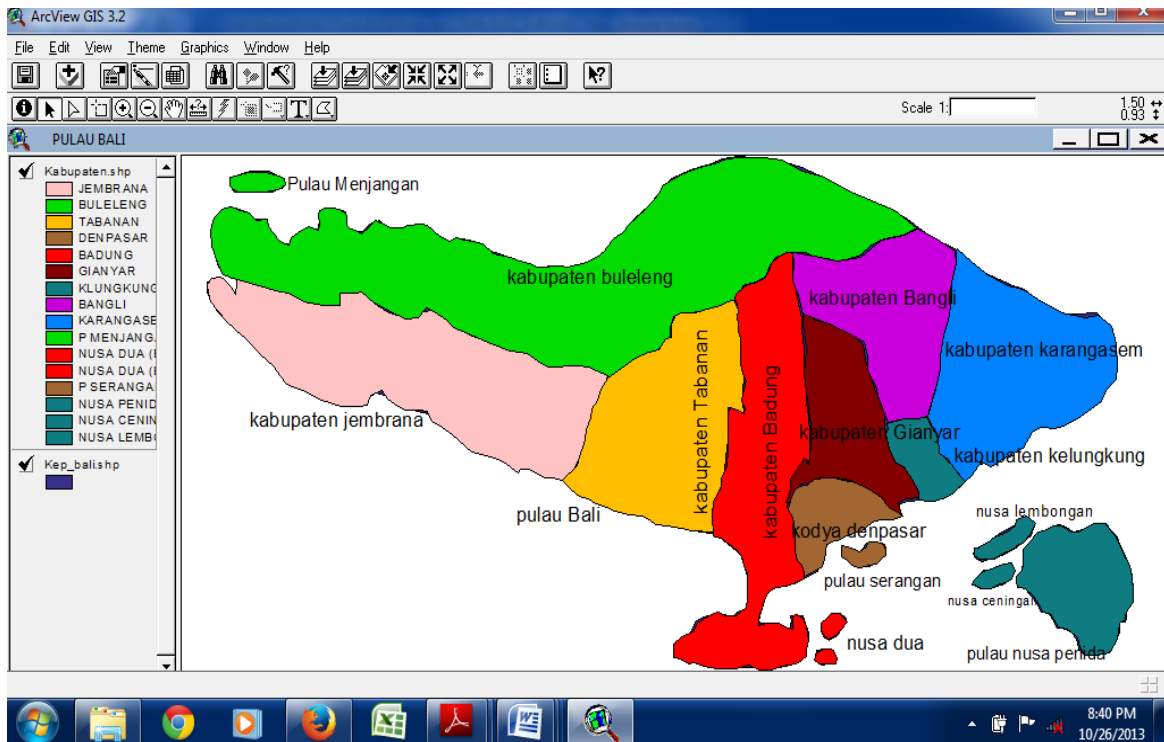
Figure 1: Result of Digitation Map of Bali Island

Here is a picture of the data described by using ERD (Entity Relationship Diagram). In making this diagram, the first step is to identify the entity (object), the second step is the identification of each attribute and the third step is the identification of relations between objects. Entity (object) in this research is as follows:

Table 1: Identify the object

Entity Name	Attribute	Data Type	Character width
Area	Id_wly	string	5
	Nm_wly	string	16
	Nm_kab	string	16
	Ibu_kota	string	20
	Luas_wly	Number	10
	Jml_kec	Number	5
College	Id_ST	string	5
	Nm_ST	string	16
	Bid_ilmu	string	30
	Jml_jurusan	number	5
	status	string	10
	lokasi	string	50
	Nm_Kab	string	20
	Telp	string	15
	website	string	50
Majoring in College	NoId_JST	string	5
	Nama_jurusan	number	16

	jenjang	string	5
	Status_jurusan	string	10
	Nm_ST	string	16
University	Id_Uni	string	7
	Nama_Uni	string	30
	Status	string	10
	Jml_F	number	5
	Jml_jurusan	number	5
	lokasi	string	50
	Nm_Kab	string	20
	website	string	50
	No_telp	string	15
Faculty	Id_F	string	7
	Nama_fakultas	string	20
	Nama_Uni	string	30
Majoring_faculty	Id_jrs	string	7
	Nama_jurusan	string	30
	Status_jurusan	string	5
	Nama_Fakultas	string	10
	Nama_Univ	string	30
Polytechnic	Id_pol	string	7
	Nm_pol	string	30
	status	string	7
	Jml_jurs	number	5
	Telp	string	15
	lokasi	string	50
	Nm_Kab	string	20
	website	string	50
Majoring_polytecnic	Id_JPol	string	7
	Nm_jurusan	string	30
	Status jurusan	string	10
	Nm_Pol	string	30
Institute	Id_Inst	string	7
	Nama_institut	string	30
	status	string	10
	Jml_jurs	number	5
	lokasi	string	50
	Telp	string	10
	website	string	50
	Nm_Kab	string	20
Faculty_Institute	Id_fakultas	string	7
	Nama_fakultas	string	30
	Nama_institut	string	30
Majoring_Institute	Id_JI	string	7
	Nama_jurusan	string	30

	jenjang	string	5
	Status_jurusan	string	10
	Nama_institut	string	30
Academy	No_akdm	string	7
	Nm_akdm	string	30
	status	string	10
	Jml_jur	number	5
	lokasi	string	50
	Telp	string	10
	website	string	50
	Nm_Kab	string	30
Majoring_academy	Id_jur_akdm	string	7
	Nama_jurusan	string	30
	jenjang	string	5
	Status_jurusan	string	10
	Nm_akdm	string	30
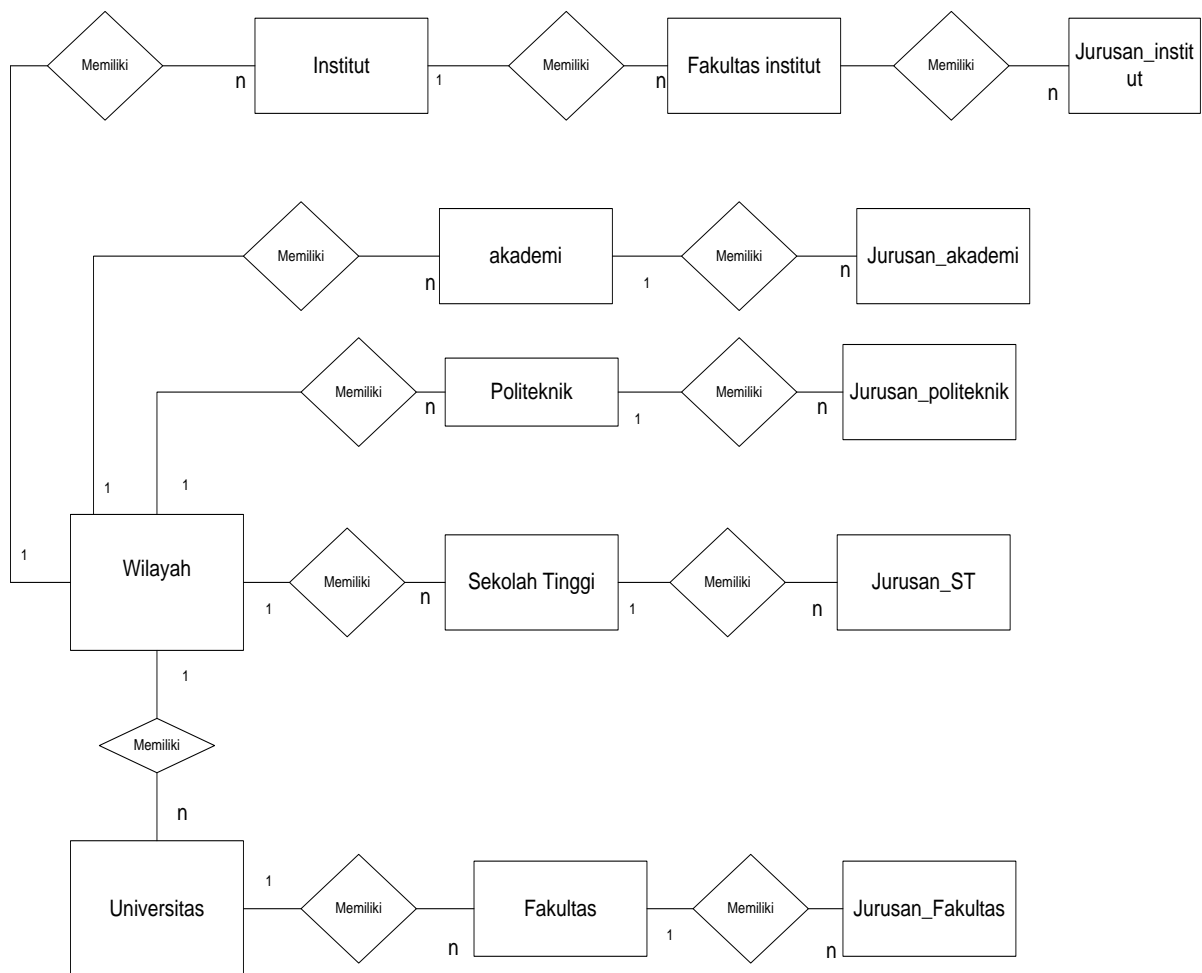
Figure 2: Entity Relationship Diagram

Information of figure 2
wilayah: area
sekolahtinggi: college
universitas: university
institute: institute
akademi: academy
politeknik: polytechnic
Fakultas_institute :Faculty_Institute
Jurusan_institut :Majoring_Institute
Jurusan_akademi :Majoring_academy
Jurusan_politeknik :Majoring_polytechnic
Jurusan_ST :Majoring_college
Fakultas : faculty
Jurusan_fakultas :Majoring_faculty

In this study, 13 entities were identified: university entity, entity area, college entity, institute entity, polytechnic entity, academic entity, faculty entity, entity faculty entity, college entity, entity majoring in polytechnic, entity majoring in academy and entity majoring in institute. The relationship between entities is one to many.

Here is a table about the districts of the island of Bali that identified the location of universities in each district / city.

Table 1: List of Regencies / Cities on the Island of Bali

Id_area	Name_area	Name_regencies	Capital_city
1	Jembrana	Jembrana	Negara
2	Buleleng	Buleleng	Singaraja
3	Tabanan	Tabanan	Tabanan
4	Denpasar	Denpasar	Denpasar
5	Badung	Badung	Mangupura
6	P. Menjangan	Buleleng	Singaraja
7	Nusa dua	Badung	Mangupura
8	Nusa dua	Badung	Mangupura
9	P.serangan	Badung	Mangupura
10	Nusa penida	Klungkung	Smarapura
11	Nusa Ceningan	Klungkung	Smarapura
12	Nusa Lembongan	Klungkung	Smarapura
13	Gianyar	Gianyar	Gianyar
14	Bangli	Bangli	Bangli
15	Klungkung	Klungkung	Smarapura
16	Karangasem	Karangasem	Amlapura

Higher education data are grouped into 5: university, institute, polytechnic, academy and college. Here is an explanation of each college.

Table 2: Number of Higher Education by Their Type

District	Amount Types Of Higher Education				
	University	Institute	Polytechnic	College	Academy
Jembrana	0	0	0	1	0
Buleleng	2	0	1	1	0
Tabanan	1	1	0	1	0
Badung	2	0	1	2	1
Bangli	0	0	0	1	0
Gianyar	0	0	0	0	0
Karangasem	0	0	0	1	0
Denpasar	7	3	2	6	7
Klungkung	0	0	0	0	0

From the results of these observations, then the analysis of the number of higher education in each district / kodya by type. Here is a chart of the number of types of higher education in each district / city.
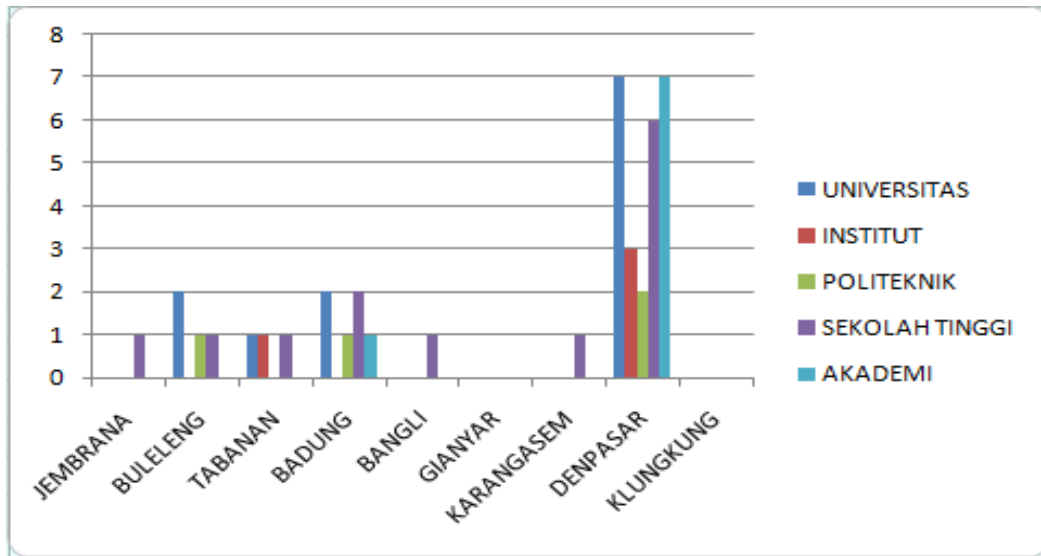
Figure 3: Chart of the number of Higher education

Based on the chart in figure 3 it is seen that the most number higher education types are universities, institutes, polytechnics, college and academics are located in Denpasar city. So the number of higher education that high most centered in the city of Denpasar while there are other districts no there are of higher education that is built Gianyar district and Klungkung district.

Implementation of spatial data analysis and non spatial data can be seen in figure 4, using ArcView software by digitizing. The results of the implementation are the cities of Denpasar and Badung regency as the second district that has the most number of higher education.
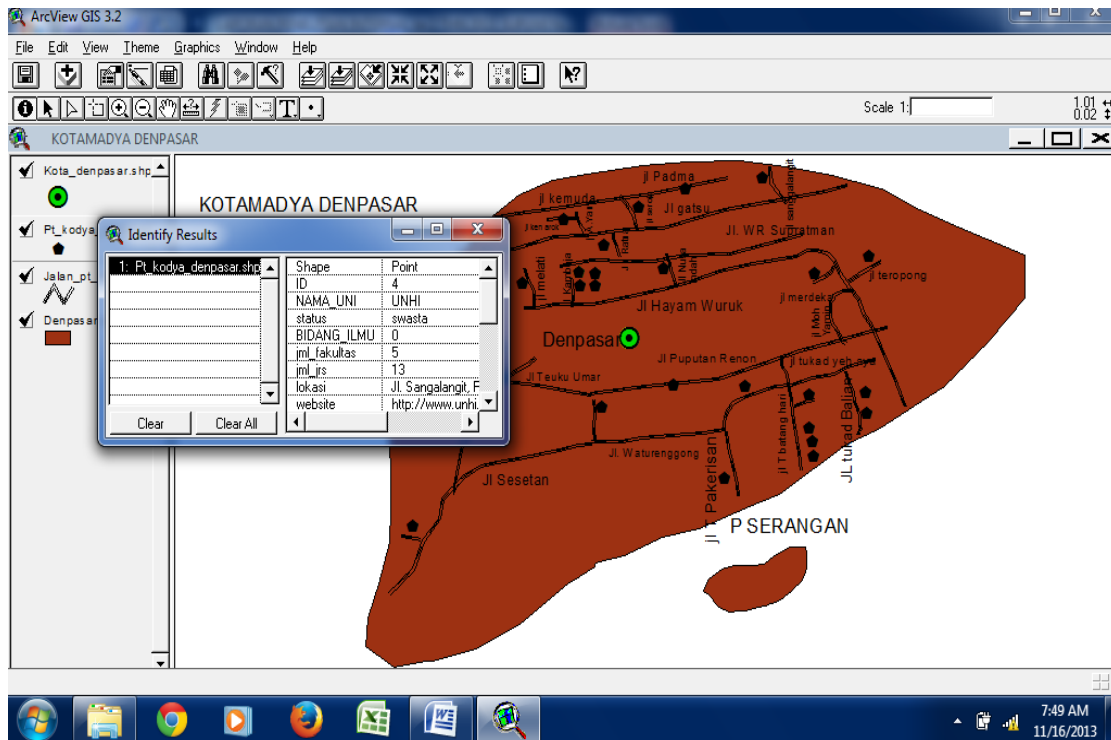
Figure 4: Digital map of higher education in the city of Denpasar

The result of integration between spatial data and non spatial data about college in Badung Regency implemented in ArcView software in the form of digital map based on geographic information system can be seen in figure 5.
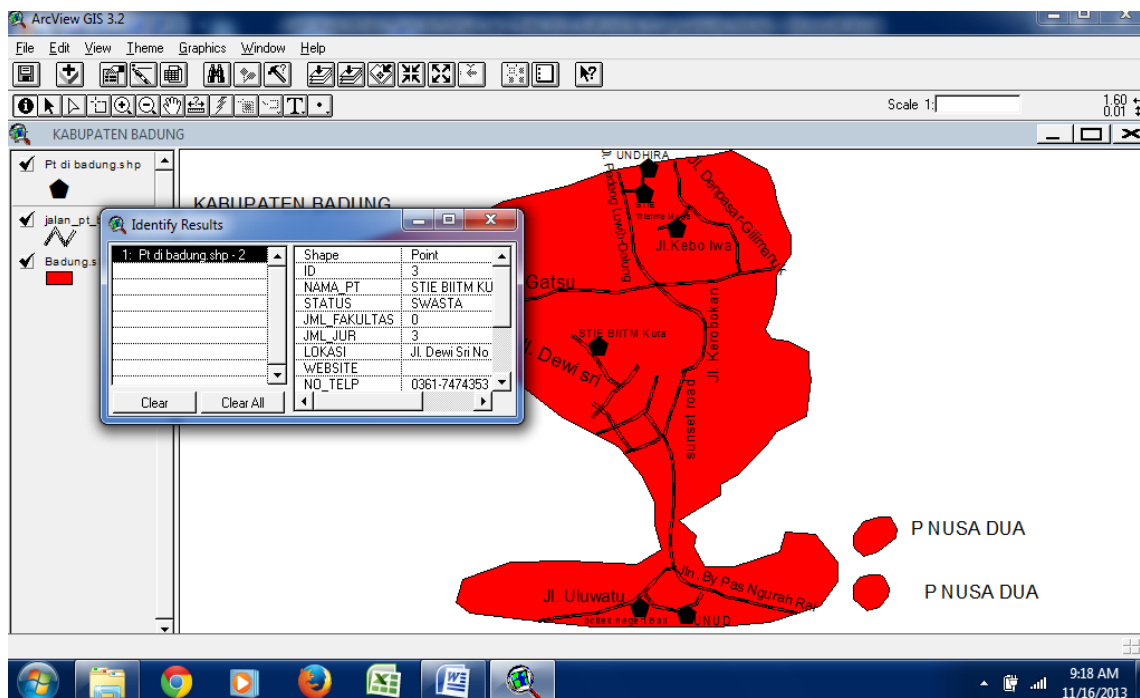

Figure 5: Digital map of higher education in the city of Badung district

4. Conclusions and Recommendations

Based on the results of the research it can be concluded that the number of universities, institutes, polytechnics, college and academies are the most abundant in Denpasar regency / municipality. The city of Denpasar still dominates the highest number of types of universities. At the university which has the most number of faculty is Udayana University with state status. In the type of polytechnic that has many majors is the polytechnic of Bali, for the academy is the tourism academy of Denpasar and for the institute is ISI Denpasar and for high school is ST Foreign Language Saraswati.

Acknowledgements

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