Integration of GIS for Mapping Distributed Online Learning

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Abstract. This study was carried out to overcome one of the main obstacles encountered, namely the lack of information on the location of student residences in private universities that provide online learning system. Quantum GIS can display the distribution of students in all regions of Indonesia. The method used in this study is the descriptive analysis method. The results of this study are presented in the form of a distribution map of online learning students across Indonesia, which shows information about student data based on a regional boundary map.

1. Introduction

In early 2020, the world was shocked by the outbreak of a new virus, namely Corona Virus Disease 2019 (COVID-19). To prevent the spread of COVID-19 in the educational environment, the Minister of Education and Culture of the Republic of Indonesia issued Notice No.4 of 2020 concerning the implementation of Education Policies in an Emergency Period for the Spread of Corona Virus Disease (COVID-19). One of the policies is written that the teaching and learning process is carried out from home through distance learning. Referring to this Notice, the teaching and learning process of all educational institutions has switched from face-to-face system to distance learning, includes primary to higher education.

The distance learning method utilized the internet and electronic media or e-learning. E-learning itself is a learning process using information and communications technology media[1]. One university that implements an e-learning system in Indonesia is a private university in Jakarta. Therefore, during the Covid-19 pandemic, this private university was ready to implement the Notice letter from the Ministry of Education.

Currently, the students at private universities that provide online learning have been geographically spread in various cities in Indonesia. The distance learning implemented by the ministry offers private universities that offer online learning education the opportunity to help high school graduate students to continue their education even during the Covid-19 pandemic. Therefore, it is necessary to map the current students geographically. Geographic data mapping uses a basic information system, i.e., a geographic information system (GIS). GIS aims to store, manage, analyze, organize, and visualize all types of geographic data[2]. Geographic information systems have been used in the search for dynamic management systems to extract land use maps, risk and resource maps for geography and disaster simulation [3][4][5]. According to Dewa (2020)[6], GIS can be used to aid learning activities related to space. The purpose of this research is to determine the distribution of students across Indonesia as an institution's data enrichment system.
2. Methodology
The design used in this research is to first conduct exploratory research to describe and understand the research problem, and then the results of the exploratory research will become the input of the descriptive research. Descriptive analysis methodology is a GIS research method used for mapping online learning students. The data used is secondary data.

3. Result and Discussion
While mapping the students, the steps in this study can be seen in the image of the fishbone flowchart below:

![Figure 1. Research procedure stage diagram](image)

At the planning stage, it begins with preparing student’s data and the QGIS application. Vector data for Indonesian maps in the form of .shp files are uploaded to the QGIS application. Student data is managed in excel and then input into the QGIS application. The maps and student data have been uploaded and inputted; the mapping process is carried out using the QGIS application. The output of mapping using the QGIS application is a map of the distribution of online learning students.

3.1. Digitizing student distribution map throughout Indonesia
After taking some steps to collect data, input the data into the GIS and management system, then generate output in the form of a digital student map. GIS digital mapping is a classic approach that builds a spatial image by combining a layer of digital information and to develop algorithms to be tested and visualized in special selection [2]. The digital map-drawing process using the Quantum GIS (QGIS) application. Quantum GIS is an open-source software that can be used for spatial data management and application development for GIS[7]. The spatial data structure used to create the geographic GIS data is used for the mapping of students in Indonesia using a vector data model. The vector data model is stored as coordinates of points, these points use dashed lines or areas to display their positions and store spatial data[8]. The implementation of the digital map in the geographic conditions of Indonesia is shown in Figure 2:
The result of digitized distribution student mapping throughout Indonesia show that many students domiciles are in Banten Province, DKI Jakarta Province, and West Java Province. The number of students in these three provinces is above 1000 students on average. At these three provinces, a mapping was carried out again into cities and sub-districts to be more specific about which cities and sub-districts where the most student domiciles are. The results of digitizing the distribution of students in the provinces of Banten, DKI Jakarta, and West Java are as follows:

a. Banten Province

The results of the student distribution map in the city of Banten province are mainly concentrated in the city of South Tangerang with a total of 573 students and the City of Tangerang with a total of 516 students. Afterward, Banten province is remapping into sub-district, and the Serpong sub-district had the most student residences with a total of 225 students.

b. DKI Jakarta Province

The results based on the student distribution map based on students in DKI Jakarta province are mainly located in South Jakarta with a total of 612 students. Meanwhile, West Jakarta with a total of 425 students, East Jakarta with a total of 424 students, North Jakarta with a total of 289
students, and Central Jakarta with a total of 215 students. The results of digitizing the distribution map of students in the province of DKI Jakarta based on the districts were mostly in Tebet sub-district with a total of 138 students, followed by Tanjung Priok sub-district with a total of 122 students and Duren Sawit sub-district with a total of 102 students.

![Distribution map of students in DKI Jakarta](image1)

**Figure 4.** Result digitized distribution map of students in DKI Jakarta Cities (left) and Sub-district(right)

c. West Java Province

According to the map of the distribution of students in various cities of West Java, many students live in Bogor City with a total of 282 students, Depok City with a total of 146 students, and Bandung City with a total of 146 students. Then, the distribution of students by area in West Java is mainly concentrated in Ciomas sub-district with a total of 55 students and West Bogor with a total of 45 students.

![Distribution map of students in West Java](image2)

**Figure 5.** Result digitized distribution map of students in West Java Cities (left) and Sub-district(right)

4. Conclusion

Based on the results of the completed study, it can be concluded that this research is able to produce a geographic information system for mapping online learning students, which contains information on the number of students in each city and sub-district. This student map can help institutions show the distribution of Indonesian students.

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