Development of Multi Platform Geographic Information System Assessment of Prospective Bidikmisi Students Using Reuse Driven Software Development Process Method

M Aris Ganiardi[1,*], Nita Novita[2], Indri Ariyanti[3], Delta Khairunnisa[4] Meli Widiastuti[5], Nyayu Adila Aprilia[6], Selamet Apriyanto[7]

[1] *Informatics Management Department, State Polytechnic of Sriwijaya*
[2] *Informatics Management Department, State Polytechnic of Sriwijaya*
[3] *Informatics Management Department, State Polytechnic of Sriwijaya*
[4] *Informatics Management Department, State Polytechnic of Sriwijaya*
[5] *Informatics Management Department, State Polytechnic of Sriwijaya*
[6] *Informatics Management Department, State Polytechnic of Sriwijaya*
[7] *Informatics Management Department, State Polytechnic of Sriwijaya*
Email: maris@polsri.ac.id

ABSTRACT

One form of selection for new student admissions at Polsri that prospective students can choose is PMDK-PN Bidikmisi (Penelusuran Minat dan Bakat Politeknik Negeri). This selection is specifically for prospective students who have achievements in various fields and are economically disadvantaged. The selection stage on this route carried out by Polsri is to assess all the achievement criteria possessed by prospective students. Furthermore, Polsri will verify the data provided by prospective students by visiting their homes. The problem that often arises at this stage is that Polsri does not yet have a map depicting the home addresses of prospective students, making it difficult for lecturers to make visits. In addition, the assessment still uses paper documents so that it is often troublesome for the assessors. In the study, we tried to create a geographic information system for assessing prospective PMDK-PN Bidikmisi students in Polsri to overcome problems during the process of accepting new Polsri students. This geographic information system is in the form of a web application created using a system development method based on reuse. The web application will be built based on the components contained in the CodeIgniter framework library and components created by the developer. The use of these components in web applications results in an efficient, effective system and without changing system functionality.

Keywords: Bidikmisi, Geographic Information System, Reusability.

1. PREFACE

The selection process for new student admissions at Polsri (Politeknik Negeri Sriwijaya) follows the regulations set by the Indonesian government. Initially, the process of accepting new students was carried out by means of a written test before the start of the new school year. The results of the written test will be ranked by value. Then the prospective student who will be accepted is determined based on the value limit and quota in the department chosen by the prospective

student. In subsequent developments, the process of new student admissions is not limited to test selection. In accordance with government regulations, student admissions can go through the PMDK-PN selection. This PMDK-PN selection can be chosen by prospective students who have achievements in academics or other fields such as sports, arts, and so on.

While studying at Polsri, students can get educational assistance in the form of scholarships. Scholarships available at Polsri come from the government, companies, and Polsri alumni. This type of

scholarship also takes many forms, there are scholarships for outstanding students, scholarships for students who are economically disadvantaged, and scholarships for students who are active in student organizations.

One of the admissions routes for new Polsri students is PMDK-PN Bidikmisi. This path is specifically for prospective students who excel and are economically disadvantaged. Achievements that will be assessed are not only limited to the academic field, but other fields such as sports and the arts, while the economically disadvantaged are declared by the authority officials in the prospective student's domicile area. The stages of admission for this pathway are as follows: prospective students register and submit all achievement documents to their schools. Polsri will then assess all of these documents. The results of the assessment will be obtained by a number of prospective students. The next stage is to verify the data and directly assess the prospective student. The method is done by sending the assessor lecturer to visit the address of the prospective student's residence. In this way the assessors can directly assess the prospective student. The results of the assessment from the assessor lecturer will be brought together at the Polsri leadership meeting to determine the graduation of prospective students to become Polsri students.

The selection process for prospective Bidikmisi students in Polsri, the assessment lecturers visited the homes of prospective Bidikmisi students to verify data and directly assess the prospective students. The problems that arose during this process were 1. Polsri did not have a map depicting the addresses of prospective Bidikmisi students. 2. The difficulty of the assessment lecturer to find the shortest route to the prospective student's home address when making a visit.
3. The assessment form for prospective students still uses paper documents so that when visiting prospective students' homes, the assessment lecturer brings many documents in the form of assessment papers.

This research, trying to create a geographic information system for the assessment of prospective Bidikmisi students majoring in Information Management Polsri to assist the selection process for new students majoring in Information Management Polsri through the PMDK-PN Bidikmisi scholarship. The web application on this system will be made in the form of reusable modules. With modules like that, making web applications will be easier and able to adapt to changing needs.

In this research, a geographic information system was used to map the domicile of prospective Bidikmisi students. With this mapping, it will facilitate the visit of the assessor lecturer. Research on mapping an area with a specific purpose has been done by many researchers in the field of computers or geography. [13] utilize

geographic information systems to determine the potential of batik in an area in Yogyakarta. These potential areas are determined based on the ease of obtaining raw materials and the ease of distribution of batik handicrafts. This information system can also be used to analyze climate, structural conditions and soil contours in an area. From the output of the application on the system, it can be seen the feasibility of the area to be used as agricultural land [12].

[9] in his research emphasized the importance of component reuse in software development. By using components, the software created will be more efficient in the use of resources. These stages of software development with reuse are described in detail by [9] and updated by [7]. The two people create models to make it easier for developers to create software. [1] created an on-line aspiration information system using software development with reusability.

2. BASIC THEORY

2.1. Geographic Information System

Geographic information system is a system designed to capture, store, manipulate, analyze, organize, and display geographic data [6]. It can be said that a geographic information system (GIS) or in English Geographical Information System (GIS) is a system that combines cartography, statistical analysis and databases.

2.2. Software Development Based on Reusability

Reuse driven software development process or software development based on reusability is one of the software development processes that is driven by the reusable aspect. This process views the process from two sides, namely customer reuse and producer reuse [9]. Customer reuse is the activity of using reusable components to create new software systems [9]. Producer reuse is the activity of making, procuring or reengineering reusable components [9].

The concept of reuse can be used in various software development methods. So that the soft`ware development process becomes reuse driven, it is enough to add customer reuse mini life cycle and producer reuse mini life cycle at each stage of development. Adding a producer reuse mini life cycle to the system life cycle means that the manufacture of reusable components is carried out in the context of a system development project and the project team is also responsible for being a reuse producer. Another way to use the concept of reuse is to separate producer reuse into its own life cycle, which is often referred to as producer reuse life cycle or domain engineering.

2.3. Bidikmisi Scholarship

Achievement Student Education Scholarship, which is abbreviated as Bidikmisi, is a tuition assistance program provided by the Government through the Directorate General of Higher Education, Ministry of Education and Culture in the United Indonesia Cabinet starting in 2010, to students who have adequate academic potential and are economically disadvantaged. Bidikmisi is a program of 100 Working Days of the Minister of National Education launched in 2010. Universities that receive Bidikmisi assistance are universities under the Ministry of Education and Culture. This program has a mission to revive hope for the underprivileged and have adequate academic potential to be able to take education up to the level of higher education.

3. RESEARCH METHODOLOGY

The stages carried out during the research work are shown in Figure 1.

1. The first step in this research is to analyze the needs of the geographic information system for the assessment of prospective Bidikmisi students (SIG Bidikmisi). System requirements analysis is carried out after the problems in the system are clearly formulated. How to conduct a needs analysis, how to conduct a survey on the implementation of the assessment of prospective Bidikmisi students, interviews with the leaders of Polsri and the lecturers involved, and analysis of documents that support the assessment activities of prospective Bidikmisi students. The results obtained from this stage are the specifications of the system to be developed.
2. The second stage of this research is to create geospatial data which will later be used in the development of the Bidikmisi GIS.
    a. Literature study, conducted by studying the literature that supports the implementation of the research. The literature is related to the concept of geospatial data, the concept of geographic information systems, dimensional modeling, the concept of reusability, reuse driven software development process and other related studies.
    b. Analysis, determining the required attributes of geospatial data for maps in geographic information systems.
    c. Design and implementation, determine geospatial data and its attributes that will be used in the geographic information system for the assessment of prospective Bidikmisi Polsri students.
3. Development of the Bidikmisi GIS based on reusability is the third stage in this research. The focus at this stage is the development of web applications that take advantage of geospatial data that has been created previously. The web application

is designed using UML (unified modeling language) notation. The CodeIgniter framework is used in working on the Bidikmisi GIS web application. In web application development there are two types of components that will be used. The first is a component that has been provided by the CodeIgniter framework and the second is a component that is made by the developer himself. Components made by developers are reusable and based on the system engineering domain.

4. The fourth stage in this research is testing the components of the Bidikmisi GIS web application. The components used are derived from the CodeIgniter framework and the components created are tested for their usefulness. The testing method is done by creating a page form functionality test scenario that utilizes these components.
5. Evaluation of the overall system is carried out at the final stage of this research. Evaluation is done by implementing the Bidikmisi GIS in the user's environment. This implementation will get feedback from the use of this geographic information system. The parameters to be measured are ease of use and data accuracy.
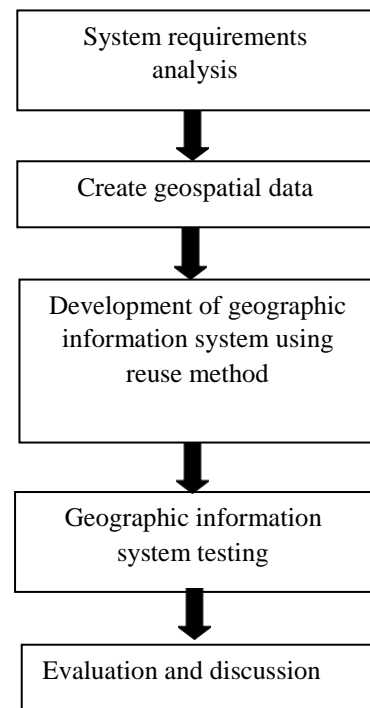

Figure 1. Research Methodology

4. RESULT AND DISCUSSION

4.1. Use Case Diagram

The use case diagram shown in Figure 2 illustrates the relationship between the actors involved and the Bidikmisi GIS. There are four actors who interact with

the Bidikmisi GIS, namely: admin who is responsible for the whole system, lecturers who serve as assessors, prospective students act as actors who are assessed by lecturers, and leaders who will determine the graduation of prospective students. From the use case diagram, it can be seen that the use cases that can be carried out by actors when using Bidikmisi GIS. Each actor has a use case depending on his role.
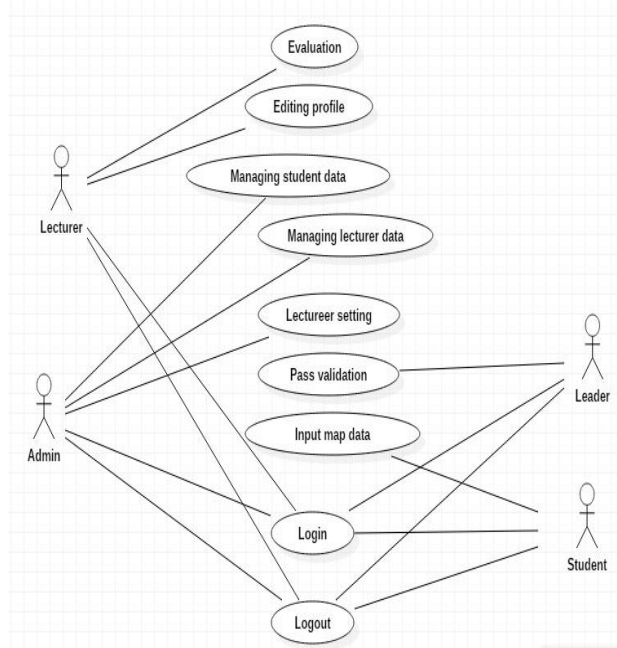

Figure 2. Bidikmisi GIS Use Case Diagram

4.2. *Geographic Information System Components*

There are three types of components that will be used in the Bidikmisi GIS web application, namely: leaflet components, components derived from the CodeIgniter framework, and components made by developers themselves.

1. Leaflet components

The important output data in the Bidikmisi GIS is a map of the domicile location of prospective Bidikmisi students. To display map data in the geographic information system, a third party component is used, namely leaflets. The leaflet component is a component created with the Javascript programming language. The advantage of this leaflet component is that it can be used in computer applications and is responsive when used on mobile devices such as tablets and smartphones. The map displayed is also very friendly, making it easier for users to use the map. The use of components in the Bidikmisi GIS is quite simple, the developer only writes down the syntax to call the leaflet component of the part of the program that needs it. When the web application is

used automatically the web application will be connected to the leaflet vendor.

2. CodeIgniter framework components

The second component that will be used is a component that comes from the CodeIgniter framework. The CodeIgniter framework provides a large number of component libraries that make it easy for developers to build applications. In making the Bidikmisi GIS web application, developers use a lot of components for web application interface pages and data processing in the database.

3. Components made by developers

Not all the components needed for developing a geographic information system web application for the assessment of prospective Bidikmisi students are available in the CodeIgniter framework. There are several components that must be made by the developer himself. There are two components made by the developer themselves, namely the login and dashboard interface components from the user and the helper component to maintain security from third parties who want to illegally enter the Bidikmisi GIS. Interface components are created using HTML tags which are separated into several files such as header.html, footer.hml, and sidebar.html. The security helper component is created using the PHP programming language. To use the component, just call through the CodeIgniter framework helper, it will automatically be used by the program in the Bidikmisi GIS web application.

4.3. *Geographic Information System Web Application*
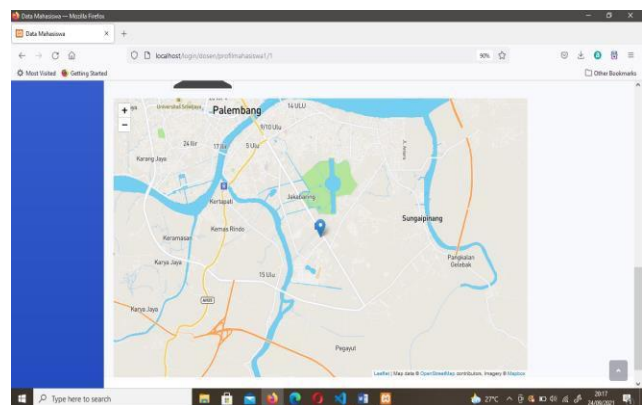

Figure 3. Domicile map of prospective Bidikmisi students

The map display in the Bidikmisi GIS web application is shown in figure 3. From the map displayed there is a pin indicating the domicile of prospective Bidikmisi students. This map makes it

easier for assessors to visit prospective students' homes. The resulting map is simple to make it easier for lecturers to carry out their duties.
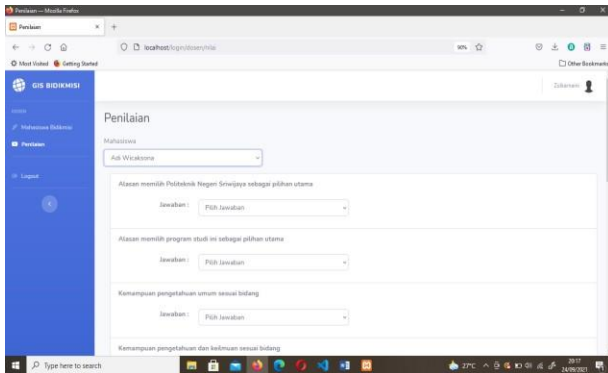
Figure 4. Bidikmisi Student Candidate Assessment Form

Figure 4 shows the assessment form for prospective Bidikmisi students during interviews with lecturers. This simple form displays a list of questions that will be asked by the lecturer to prospective Bidikmisi students. During the interview the lecturer asks questions based on the form and chooses the answers provided on the form. The Bidikmisi GIS web application will automatically calculate the total score based on the answers of prospective Bidikmisi students.

4.4. Result Evaluation

The completed Bidikmisi GIS web application is implemented in the user's environment. From the implementation results, it was obtained from users that the GIS web application was easy to use and quite helpful in the selection process for Bidikmisi student admissions. Friendly page views and a simple user process are the most important values of user ratings. The use of the Bidikmisi GIS web application can be used on various hardware devices such as PCs, laptops, and responsiveness to mobile devices such as tablets and smartphones is a separate assessment for users. The operation of the Bidikmisi GIS web application is efficient and does not require a long time due to the use of the components used by the web application. Components work when needed by the web application, whereas if they are not needed then the components do not work.

5. CONCLUSION

The conclusions obtained from this research are as follows:

1. The geospatial data contained in the geographic information system helps the assessor lecturer when

visiting the residence of prospective Bidikmisi students.

2. In this study, there are three types of components used in the development of a geographic information system for the assessment of prospective Bidikmisi students. The first component is leaflet component show the map home of propective student. The second component used is a library in the CodeIgniter Framework and the third component is a component created by the developer team.

3. The components used and made are reusable so as to summarize the program code. The Bidikmisi GIS web application in the system only calls the components that are needed when the component is used when the web application is working.

4. The functionality of the geographic information system web application does not change when utilizing these components. Web application performance becomes more efficient because not too much program code is written.

5. Based on the evaluation results from users of the Bidikmisi GIS web application, the resulting Bidikmisi GIS is easy to use by users.

6. RECOMMENDATION

The geographical information system web application for the assessment of prospective Bidikmisi students needs to be added with features. One feature that is very helpful for lecturers when making visits is to determine the shortest route for the position of the assessor lecturer to the residence of prospective Bidikmisi students and the time it takes to get there. It is hoped that further research can add these features.

REFERENCES

[1] Ali Fikri, Ismiarti, Fajar Pradana. "*Pengembangan Sistem Informasi Aspirasi Online Berbasis Web Menggunakan Pemodelan Reuse-Oriented Development (Studi Kausu : DPM Universitas Brawijaya*". Jurnal Pembangunan Teknologi Informasi dan Ilmu Komputer. Vol. 3No.2, hlm. 1174-1183, e-ISSN : 248-964x. 2019.

[2] Coad, P. "*Object models: Strategies, patterns and applications*". Upper Saddle River, NJ: Pentice Hall. 1997.

[3] Galin, Daniel. "*Software Quality Assurance from Theory to Implementation*". Pearson Addison Wesley. 2004.

[4] Gamma, Erich. Helm, Richard. Johnson, Ralph. Vlissides, John. "*Design Patterns : Elements of*

Reusable Object-Oriented Software". Addison-Wesley Professional Computing Series. 1997.

[5]   Indah Permata Sari. "*Gaya Hidup Mahasiswa Penerima Beasiswa Bidikmisi*". Skripsi Universitas Negeri Jakarta. 2012.

[6]   Irwansyah, Edy."*Sistem informasi geografis: prinsip dasar dan pengembangan aplikasi*".Yogyakarta: Digibook. 2013.

[7]   Jasmani & Santosa, A. A. "*Implementasi Teknologi Google Maps Apiuntuk Pembuatan Sistem Informasi Databasebangunan Gedung Dan Kantor Negara*". Jurnal Spectra, 11(12), pp. 15-37. 2017.

[8]   John E. Harmon, Steven J. Anderson. "*Design and Implementatiom of Geographic Information Systems*". John Wiley and Sons: New Jersey. 2003.

[9]   McClure, Karma."*Software Reuse Techniques: Adding Reuse to the System Development Process*". Prentice Hall PTR. 1997.

[10] Pedoman Penyelenggarakan Bantuan Biaya Pendidikan Bidikmisi. Jakarta: Dirjen Dikti. 2014.

[11] Pressman, Roger. "*Software Engineering Fifth Edition*". John Wiley & Sons. 2010

[12] Rika Harini, Bowo Susilo and Emilya Nurjani. "*Geographic Information System-Based Spatial Analysis ofAgricultural Land Suitability in Yogyakarta*". Indonesian Journal of Geography. Vol. 47, No. 2. ISSN 0024- 9521.2015.

[13] Taryadi, Sattriedi Wahyu Binabar, Dicke JSH. Siregar. "*Geographic Information System for Mapping the Potency of Batik Industry Centre*". Journal of Information Systems Engineering and Business Intelligence. Vol 5 No.1. 2019.