Recommendation system for selecting universities in Indonesia using Google Maps API services

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Abstract. University is the highest education level to be achieved by many people in Indonesia. Finding information about universities is often required by Senior High School students to continue their studies. This information contains the university name, location and the quality of the majors. Distance is one of the factors that becomes the consideration for many people to pursue the higher education. Thus, the use of supporting technology to search the nearest campus will be needed by these students. The purpose of this research is to design the system that can facilitate the students in Indonesia in choosing the nearest university based on majors, accreditation, city, and province. The searching method to get the nearest location is also done by Google Maps API Service. The amount of data to be used in this research are from DIKTI that include list of universities and majors in Indonesia. The results of this study expect the college recommendation can be used as a reference for students in choosing college at college.

1 Introduction

University is the highest education level pursued after high school. A university provides undergraduate and postgraduate education. The higher education is made into three, namely Academic Education, Vocational Education, and Professional Education / Specialist. The Academic Education is a system of higher education that leads to the mastery and development of certain disciplines of science, technology, and art. The Academic education includes Bachelor (S1), Master (S2) and Doctoral (S3) degree. A graduate of the Academic Education earn a degree, followed by its expertise. For example, Bachelor of Economics, Bachelor of Law, and so on. The Vocational Education is a system of higher education that leads to the mastery of certain applied skills. The Vocational Education includes Diploma I (D1), Diploma II (D2), Diploma III (D3) and Diploma IV (D4) courses. Graduated from this type of education also get Vocational degrees, for example, Primary Experts (A.P.), Young Experts (A.Ma.), Madya Experts (A.Md.), and so forth. While the Professional Education / Specialist is a system of higher education where education is directed at work for special skills.

The higher education level has an important role in the development of education in Indonesia. The university is an undergraduate creator institution that puts graduates who have the competitiveness and independence to compete at national and international level. This competitiveness is indicated by the large number of Indonesian universities spread in each province. Based on data obtained from FORLAP DIKTI, the number of universities in Indonesia amounted to 4606 universities consisting of Academy, Polytechnic, High School, Institute and University [1]. It makes high school students selectively choose their university of choice in accordance with the choice of majors, the quality of the university and its majors. The quality of the university or majors can be seen through the accreditation. The accreditation data of majors can be obtained from BAN-PT, therefore the students can find out the quality of university and the departments by accessing the data on BAN-PT website [2]. Further, another important factor is the distance from the students to the university of their choice, so that the closest distance is one of the criteria in determining the university chosen by high school students.

Technological developments have helped humans to improve their quality of life [3], one of which is information technology [4]. Information technology is evolving today, enabling one to navigate digitally through online maps [5] . This navigation can help a person in making a decision and giving the value of service [6]. In the field of information technology, such capabilities are known as decision support systems which are knowledge-based systems or knowledge management used in support of decision-making. It can also be said to be a computer system that processes data into information to make decisions from a specific semi-structured problem [7]. While the recommendation system is a system that is commonly used by researchers. The approaches conducted by filtering the search result from the favored or not [8].

In the current development of technology and information, the information mapping is often done for the activities of an area, such as cultural, cultural,

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artistic, sports and other events [9]. The closest search (shortest path) is one of the most frequently used features in navigation. The nearest route becomes an option for everyone as it can save them a lot of time to get to their destination [10]. Currently, the use of navigation for the nearest search has been used by various service companies in the transportation service industry, delivery of goods, and the search of places [11]. This navigation path makes recommendations for the users, therefore search effectiveness can be achieved.

Several other researches that utilize navigation as a recommendation system include research conducted by Pan, Crotts, and Muller that develop Tourist Information on a Web platform that focuses on tools for travel guiding and planning. The Google Maps API is used to take pictures on maps and information for destination routes [12]. Other uses in the form of android applications implemented by Bahar and Saputra on their research focusing on providing location service information or positioning directions at public and private universities Banjarbaru City. The results of this research indicate that the position of the university location can be accessed and provide information of the position of the nearest path to the campus by using access to services provided by Google, as well as the use of Global Positioning System (GPS) in directing the user location [13]. Another research that utilizes Google Maps API is the development of mobile device based Geographic Information System Location Tour in Semarang. In the study, the application of haversine formula is done to provide information about tourist destination radius from where the tourists are [14]. The benefit of this research is for high school students to get recommendation of Higher Education of their choice based on the university quality measured from accreditation and the nearest university search in accordance with the student's domicile.

2 Methodology

The methodology used in designing the Higher Education recommendation system in Indonesia uses the Rational Unified Process (RUP). There are four planning stages using this method [15].

a. *Inception.*
   It is an analytical phase, the phase is the initial steps that identifies the requirements of user needs and perform the design of the device or application to be created. In addition, data collection is done at this stage are obtained from Forlap DIKTI.
b. *Elaboration.*
   The second stage is the design phase stage of the software or application to be built, in accordance with the results of the analysis in the previous phase. This stage is commenced by specifying software features up to the prototype release of the software.
c. *Construction.*
   In this stage, the application development will be done immediately.
d. *Transition.*
   Installation, distribution and socialization of the software will be conducted in this stage. This phase is the application evaluation stage based on the needs of the user after the test is done.

The recommendation system of choosing the university involves several interconnected components, namely the database, server, internet and users. The university data and major are stored in the database in the server. The internet access is required to access the data input by the Administrator. Further, the recommendation of the university requires Google Maps API Services which is a Javascript based technology [16] given to recommend the map navigation to see the closest distance and travel time so that the user can see the closest university search recommendation result. In Figure 1, the architecture of the closest university choice recommendation system is shown.

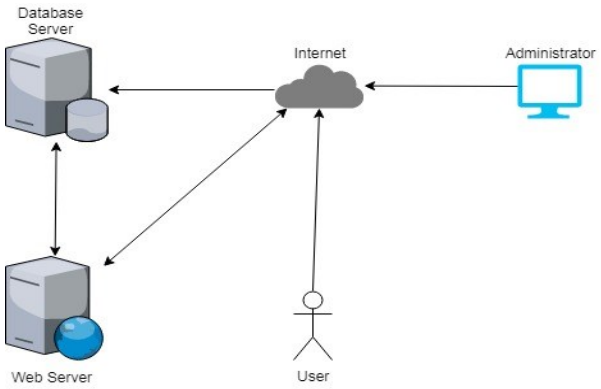

Fig. 1. Architecture of the University Recommendation System

The figure showed the architecture of recommended system to displaying the location of university based on major from the user origin. The system using internet connection, which the data are getting from database server. The application are located in web server. In addition, administrator can access this system to update the data of university, including the major, accreditation, province, city, and status of university.

3 Result and Discussion

Inception are consist of analytical stage. In this stage, it includes the activities that defines functional needs and non-functional needs of the University Recommendation System. Furthermore, the data are collected from Forlap DIKTI. The data consists of the information such as the name of university, the major, accreditation, province, city, and status.

3.1 Functional Requirements

Based on the result of the functional requirements analysis to the university recommendation system development, there are several functional activities such as system can validate user login, the system requires user registration, displaying notification, the system can

manage the data of university, searching by criteria and displaying the distance information from people origin.

Table 1. Functional Requirements.

ID	Needs
FR-001	System can validate user login
FR-002	System can process user registration
FR-003	System can display notification
FR-004	System can process manage the data of university
FR-005	System can display the information list of the available universities
FR-006	System can process the university search based on Major, Accreditation, Province, City, and Status (Public/Private)
FR-007	System can display the search result
FR-008	System can display the distance information to a certain university.

3.2 Non-functional Requirements

Based on the analysis of the non-functional requirements to the development of university recommendation system, there are several non-functional needs such as the parameter of availability, portability, security. The details of non-functional requirements is as follows:

Table 2. Non-functional Needs.

ID	Parameter	Needs
ADPTI-NFR-001	Availability	As long as connected to internet
ADPTI-NFR-002	Ergonomy	Website display to be made as responsive as possible by using library css bootstrap
ADPTI-NFR-003	Portability	Can be used in every platform
ADPTI-NFR-004	Security	Admin / Member uses login password that is encrypted to MD5

3.3 System Implementation and Testing

In this phase, the functional requirement is changed into list of entity requirement. This entity requirement include the data requirement which are described in part 3.3.1. After that, the entity relationship diagram are shown in figure 2. The diagram illustrates the connectivity between entity in this recommendation system.

3.3.1 System Implementation

In this part, functional requirement are generated into data requirement. Data requirements are needed for developing the system and make sure the data are available in the system. The data requirements are as follows:

1) Data of the University
2) Data of the Majors
3) Data of the City
4) Data of the Province

Next, the data requirements are converted into entity which illustrated in Entity Relationship Diagram. The diagram shows eight entity. There are Data User, Data Perguruan Tinggi, Data Jurusan, Data Notifikasi, Data Lokasi, Data List Jurusan, Data Provinsi and Data Kota. Data user provide the information of user that access the system. Data Perguruan Tinggi includes the general information from universities. Data Jurusan has list information about the major from universities. Data notifikasi uses for giving notifications to the user. Data lokasi has the information about university address and related with entity of Data Kota and Data Provinsi. Both of them provide the information of city and province. Last, the entity of Data List Jurusan uses collecting the major of universities. The details of E-R Diagram are showed in in Figure 2.

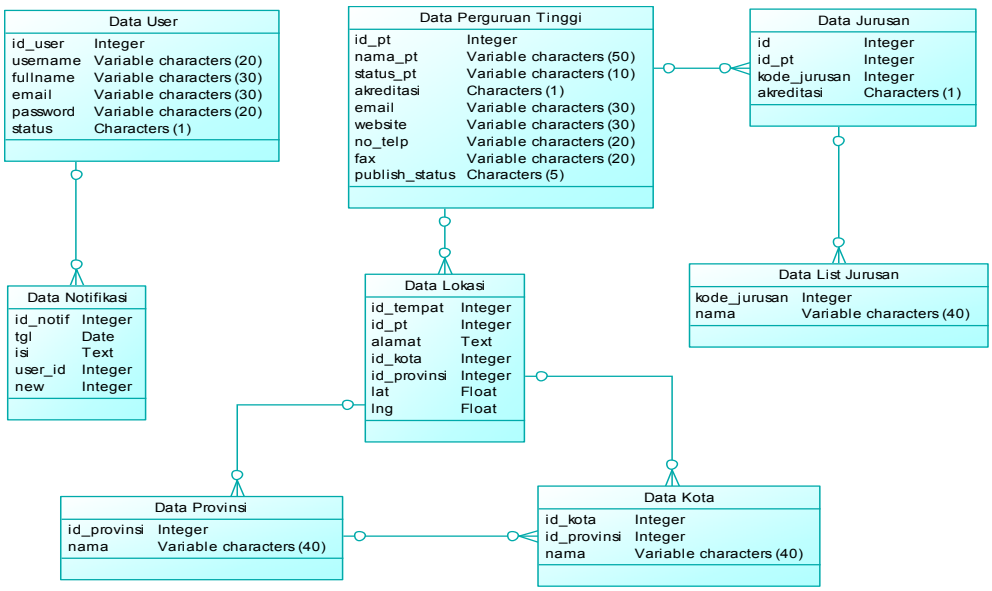

Fig 2. E-R Diagram

3.3.2 System Testing

The following describes how the system testing is conducted. The testing conducted is by displaying the result of the university search by seeing the content of the university in advance. In Figure 3 the list of universities is shown.

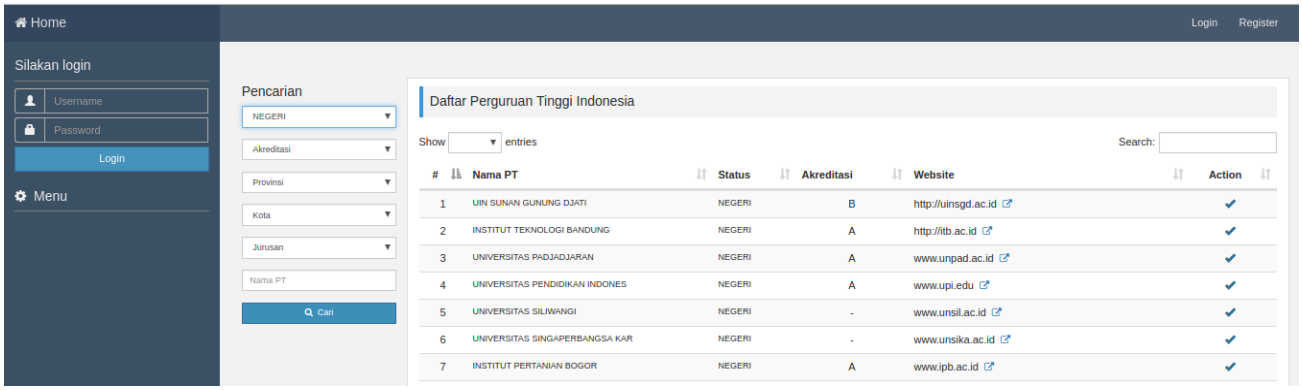

Fig. 3. Display of List of University in Indonesia.

The result of the closest university search is seen from the distance radius shown when running the navigation to the directed university. Figure 4 shows the running navigation process so that the distance of the user and the university is seen, as well as the traveling time to the university. The following is the display of the distance resulted when the navigation is directed to the university in Figure 4.

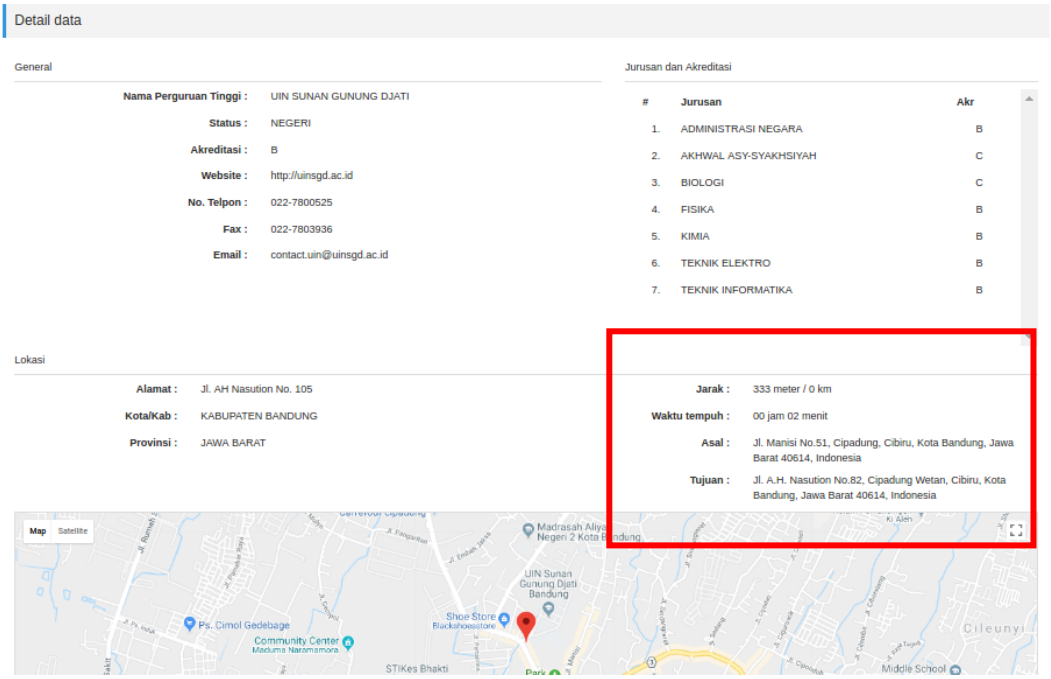

Fig 4. Distance and Estimation Time to the Destination of University.

Table 3 shows the result of finding destination of university from the origin place. In this table, the takes the destination to the university in Indonesia such as Institut Teknologi Bandung, Universitas Padjajaran, Universitas Pendidikan Indonesia, UIN Sunan Gunung Djati Bandung, and etc. The origin place takes from the same place. From the table, it can be described to get through the Institut Teknologi Bandung it takes 31 minutes with the distance of 13 kilometres. Besides that, it needs 11 hours 45 minutes to reach the location of Universitas Hasanuddin, Makassar with the distance of 1609 kilometres. In addition, all of the results for measuring distance and estimating time can be seen on figure 5.

Table 3. The result of distance and time estimation to the University.

No.	Destination	Estimated time	Distance
1.	Institut Teknologi Bandung	13,675 meters / 13 kilometres	31 minutes
2.	Universitas Padjajaran	33,778 meters / 33 kilometres	47 minutes
3.	Universitas Pendidikan Indonesia	16,699 meters / 16 kilometres	44 minutes
4.	UIN Sunan Gunung Djati Bandung	34,920 meters / 34 kilometres	49 minutes
5.	Universitas Siliwangi	121,666 meters / 121 kilometres	03 hours 17 minutes
6.	Universitas Singaperbangsa Karawang	87,897 meters / 87 kilometres	01 hour 32 minutes
7.	Sekolah Tinggi Teknologi Garut	73,458 meter / 73 kilometres	01 hour 54 minutes
8.	Telkom University	18,379 meters / 18 kilometres	33 minutes
9.	Universitas Indonesia	150,174 meters / 150 kilometres	02 hours 38 minutes
10.	Universitas Gadjah Mada	406,510 meters / 406 kilometres	10 hours 02 minutes
11.	Institut Teknologi Surabaya	784,807 meters / 784 kilometres	14 hours 19 minutes
12.	Universitas Brawijaya	783,697 meters / 783 kilometres	15 hours 33 minutes
13.	Institut Pertanian Bogor	183,345 meters / 183 kilometres	03 hours 13 minutes
14.	Universitas Hasanudin	1,609,224 meters / 1609 kilometres	11 hours 45 minutes
15.	Universitas Negeri Yogyakarta	407,205 meters / 407 kilometres	10 hours 03 minutes

4 Conclusion

The university recommendation system development generates convenience to the users in accessing the information since it is accessed via web platform. This system certainly can help users in accessing information about the university based on several parameters such as majors, accreditation, city and province. The subsequent development of the recommendation system for the selection of the study program requires the development of which was published on a global scale in order to be used by all students who need it and to be installed on mobile devices.

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