

# Mobile Web-Based Campus Life Introduction Information System Using the K-Means Method

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## Abstract

**Abstract**— The introduction of new student campus life (PKKMB) is an annual activity carried out by the Lhokseumawe State Polytechnic campus which aims to prepare new students to go through the transition process to become mature and independent students, as well as accelerate the process of adapting students to a new environment and providing provisions for their success in pursuing education. at University. PKKMB must be carefully planned with several stages in it so that it can be used as a momentum for new students to get accurate information about the education system in higher education, both in the academic and non-academic fields. The small result of the lack of preparation of the activity implementers, sometimes making several stages in this activity, especially in the grouping of new student data, is not optimal, causing several problems such as lack of funding for activities and human errors. The purpose of this research is to build a mobile web-based information system that is useful for making it easier for executors to carry out several stages in this activity, especially in the grouping of new students. So that the purpose of this activity can be maximally accepted both for new students and executors. To collect the data needed in building this system is by conducting interviews with activity executors, and observations. The target of this research is a system website that provides features to facilitate several stages in PKKMB activities. At the stage of grouping new student data, this system uses the K-Means method to cluster new student data with national exam scores and report cards to produce clusters according to the predicate smart, medium, and less, then the results of the clusters will be grouped into 30 groups. according to their respective selection paths.

**Keywords**— Information System, PKKMB, K-Means, Student

## 1. Introduction

In order to prepare new students to undergo the transition process toward becoming mature and independent individuals, as well as to accelerate their adaptation to a new environment and provide the foundation for success in pursuing higher education, the *Pengenalan Kehidupan Kampus Mahasiswa Baru* (PKKMB) or Introduction to Campus Life for New Students program is conducted. The PKKMB must be carefully planned to serve as a momentum for new students to obtain accurate information regarding the higher education system, both in academic and non-academic aspects. The State Polytechnic of Lhokseumawe (PNL) is one of the vocational higher education institutions in Indonesia, consisting of 24 study programs integrated into six departments. In 2018, PNL admitted 1,300 new students, and in 2019, the number increased to 1,400. All new students are required to participate in the PKKMB activities organized by the Student Executive Board (BEM), which has been granted the authority to manage the implementation.

The activities involve several preparation stages before execution, including information dissemination, registration of new students, certificate distribution, and student grouping. During the data grouping process, the organizing committee must ensure the number of registered students and determine clusters based on desired criteria. These criteria may include report card grades and national exam scores obtained during high school. Currently, all PKKMB stages are still conducted conventionally, particularly in the student data grouping process. As a result, data redundancy, human errors, internal conflicts among committee members, and time inefficiency often occur, affecting both the funding and the overall time consistency of the program. The K-Means method is a

non-hierarchical data clustering technique that partitions existing data into two or more groups. This method classifies data so that items with similar characteristics are grouped together, while those with different characteristics are placed in separate clusters. The main objective of this clustering process is to minimize the objective function within each group and maximize the variation between groups [1].

Several previous researchers have applied the K-Means Clustering technique in their studies on data grouping. For example, Ediyanto et al. (2013) in their study entitled "Classification of Characteristics Using the K-Means Cluster Analysis Method" explained that the K-Means Cluster Analysis method is quite effective for classifying object characteristics. The K-Means algorithm is also not affected by the sequence of input objects, as demonstrated when the researchers randomly selected initial cluster centers at the beginning of the computation process [2]. Based on the aforementioned issues, the author conducted a study entitled "Web-Mobile Based Information System for New Student Orientation (PKKMB) Using the K-Means Method", aiming to develop a system that simplifies all stages of the PKKMB activities.

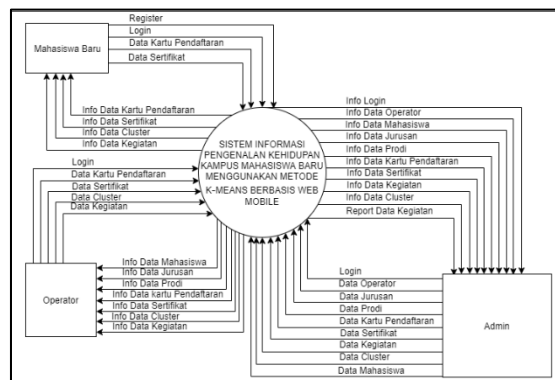
## 2. Methods

The data collection techniques used in this research include interviews, observations, and literature studies with related parties to obtain the necessary information and datasets. System requirements analysis is one of the stages in the system development process (Waterfall Model) that aims to identify the needs required by users. In designing this system, both data requirements analysis and functional and non-functional requirements analysis are conducted.

- Functional Requirements for Admin  
Functional requirements are the needs related to the data processing operations within the system. *Kebutuhan Fungsional Admin*. Functional Requirements for Admin: The admin can add, edit, and delete department and study program data, the admin can delete and reset (password) student data, The admin can verify student registration card data, The admin can verify student certificate data., The admin can edit the PKKMB certificate format, The admin can add, edit, and delete activity data, The admin can add, delete, and reset (password) operator data, The admin can perform the clustering process of new student data, The admin can view PKKMB activity reports.
- Functional Requirements for Operator: Operators can view department and study program data. Operators can view student data. Operators can verify registration card data. Operators can verify certificate data. Operators can add, edit, delete activity data. Operators can carry out the process of clustering new student data.
- Functional Requirements for Student : The user can fill in personal data, The user can select diseases and their symptoms, The student can download the registration card, The student can download the certificate, The student can view activity data, The student can view the results of new student data grouping.

### A. System Design

A context diagram illustrates the primary inputs, the overall system, and the outputs. It represents the highest level of the data flow diagram (DFD) and contains only one process that shows the system as a whole. This diagram does not include data storage and uses simple data flow representations. The process is labeled as number zero [3].



Gambar 1. Context Diagram

Based on Figure 1 above, it represents the most common flow that outlines the overall scope of the system, showing how entities are interconnected. This process involves three main entities: the admin, the operator, and the new student. A more detailed explanation of each entity involved in the New Student Campus Life Introduction System Using the K-Means Method Based on Web-Mobile is as follows:

1. Admin — The admin plays a crucial role in the system, as they have full access rights. The admin acts as the *Steering Committee* of the PKKMB (New Student Orientation Program) activities, responsible for overseeing all processes. The admin can log in, manage operator data, department and study program data, student data, registration card data, certificate data, and event data. The admin can also perform clustering of new student data (*data clustering*) and view PKKMB activity reports.
2. Operator — The operator serves as the *Organizing Committee* who operates the system. The operator can log in, manage registration card data, certificate data, event data, and new student certificates. The operator can also perform clustering of new student data (*data clustering*).
3. New Student — New students have access rights to register, log in, and download their registration card and certificate after verification by the operator. They can also view the activities managed by the admin and operator as well as see their clustering data.

A Data Flow Diagram (DFD) is a tool used to illustrate an existing system or a new system to be developed, logically representing how data flows within the system, without considering the physical environment where the data moves or is stored [4].

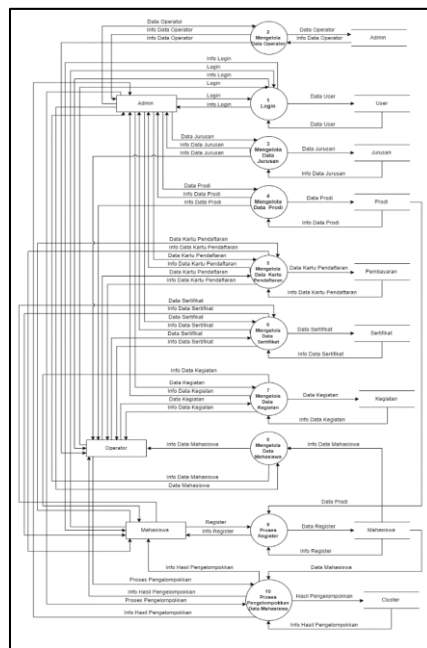


Figure 2. DFD Level 0

Based on Figure 2 (DFD Level 0) above, it illustrates the processes within the Information System for the Introduction to Campus Life for New Students using the Web-Mobile-Based K-Means Method at Politeknik Negeri Lhokseumawe, which was developed based on the context diagram. The system processes are divided into ten main processes. The Entity Relationship Diagram (ERD) is used for modeling a relational database. Therefore, if the database uses an Object-Oriented Database Management System (OODBMS), the design of the database does not require the use of an ERD.

### 3. Result and Discussions

The User Interface Display is the result of the previously conducted design process and the testing of various system access points such as the main page, login process, and others.

#### - Main Page

The main page is the initial screen displayed by the Information System for the Introduction to Campus Life for New Students Using the Web-Mobile-Based K-Means Method when a user accesses the system's domain. This page contains information about the activities data as well as a login button for users who wish to log into the system. The user interface for the main page can be seen in the figure below.



Figure 4. Main Page

- 1) The Login Page is the next page displayed when the user selects the login button on the main page. This page contains a login form with username and password fields, along with login and register buttons. After the user successfully logs in, they will be directed to the user dashboard according to their respective access rights. The user interface for the login page can be seen in the Figure 5.



Figure 5. Login page

- 2) The Register Page is displayed when the user selects the register button on the login page. This page is intended for new students to create an account in order to log into the system by filling out the required fields provided on the registration form. The page also includes a register button to save the entered data into the system. The user interface for the register page can be seen in the Figure 6.

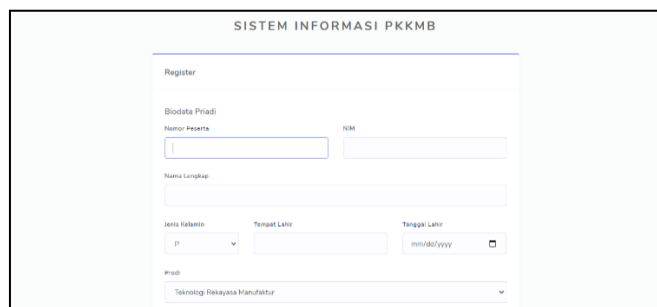


Figure 6. Register page

- 3) The Dashboard serves as the central control panel that manages all the menus available in the system. Each user has different access rights to the dashboard. Within the dashboard, there are several navigation menus that users can use to access the various pages available in the system. The user interface for the dashboard can be seen in the Figure 7.

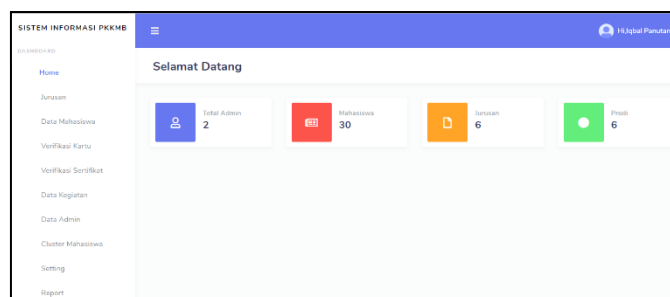
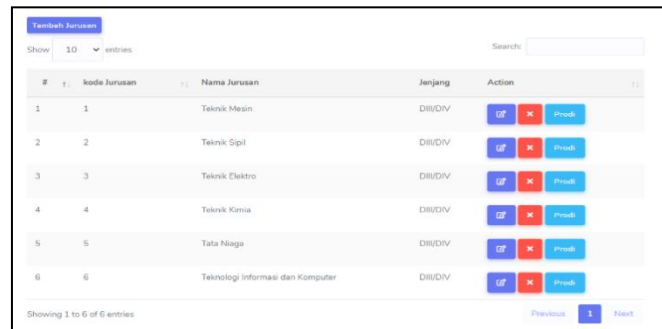


Figure 7. Dashboard

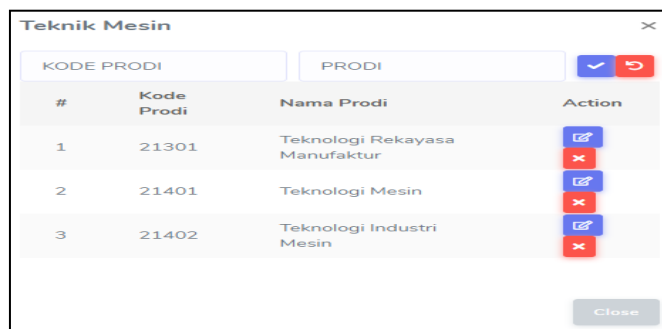
- 4) The Department Page displays the list of departments that have been entered by the admin. The displayed data includes the department code, department name, and level of study. In addition to displaying department data, this page also provides features to add, edit, and delete department records, as well as a button to view the study programs (prodi) associated with each department. The user interface for the department page can be seen in the Figure 8.



#	Kode Jurusan	Nama Jurusan	Jenjang	Action
1	1	Teknik Mesin	DI/IV/IV	[Add] [Edit] [Delete] [Prodi]
2	2	Teknik Sipil	DI/IV/IV	[Add] [Edit] [Delete] [Prodi]
3	3	Teknik Elektro	DI/IV/IV	[Add] [Edit] [Delete] [Prodi]
4	4	Teknik Kimia	DI/IV/IV	[Add] [Edit] [Delete] [Prodi]
5	5	Tata Niaga	DI/IV/IV	[Add] [Edit] [Delete] [Prodi]
6	6	Teknologi Informasi dan Komputer	DI/IV/IV	[Add] [Edit] [Delete] [Prodi]

Figure 8. Department Page

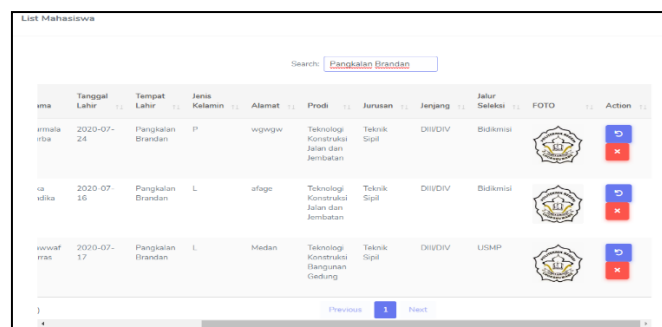
- 5) The Study Program Page is displayed when the study program (prodi) button on the department page is selected. This page shows the list of study programs registered under a specific department. In addition to displaying data, the page also provides features to add new study programs, as well as edit and delete existing ones within that department. The user interface for the study program page can be seen in the Figure 9.



#	Kode Prodi	Nama Prodi	Action
1	21301	Teknologi Rekayasa Manufaktur	[Add] [Edit] [Delete]
2	21401	Teknologi Mesin	[Add] [Edit] [Delete]
3	21402	Teknologi Industri Mesin	[Add] [Edit] [Delete]

Figure 9. Study Program Page

- 6) The Student Data Page displays the list of newly registered students in the system. The data shown on this page includes participant number, student ID (NIM), name, date of birth, place of birth, gender, address, study program, department, level of study, admission pathway, guardian's phone number, photo, as well as reset password and delete buttons. The user interface for the student data page can be seen in the Figure 10.



NIM	Nama	Tanggal Lahir	Tempat Lahir	Jenis Kelamin	Alamat	Prodi	Jurusan	Jenjang	Jalur Seleksi	FOTO	Action
emma- rika		2020-07- 24	Pangkalan Brandan	P	wgwgw	Teknologi Konstruksi Jalan dan Jembatan	Teknik Sipil	DI/IV/IV	Bidikmis		[Reset Password] [Delete]
ga- vika		2020-07- 16	Pangkalan Brandan	L	afage	Teknologi Konstruksi Jalan dan Jembatan	Teknik Sipil	DI/IV/IV	Bidikmis		[Reset Password] [Delete]
riwaf- mas		2020-07- 17	Pangkalan Brandan	L	Madan	Teknologi Konstruksi Bangunan Gedung	Teknik Sipil	DI/IV/IV	USMP		[Reset Password] [Delete]

Figure 10. Student Data Page

The Registration Card Verification Page enables the admin and operator to review and validate registration card requests submitted by new students. This page displays a list of registration requests containing the registration number, student name, payment date, proof of payment, status, and action buttons for verification and cancellation. The user interface for this page is shown in the Figure 11.

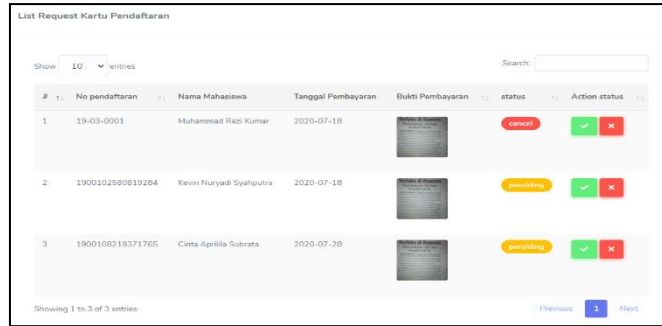


Figure 11. Registration Card Verification Page

- 7) The Certificate Verification Page allows the admin and operator to view certificate data and verify certificates for new students. This page displays certificate information such as the student’s name, status, verifying admin, date, as well as buttons for verification and cancellation. The user interface for the certificate verification page can be seen in the Figure 12.

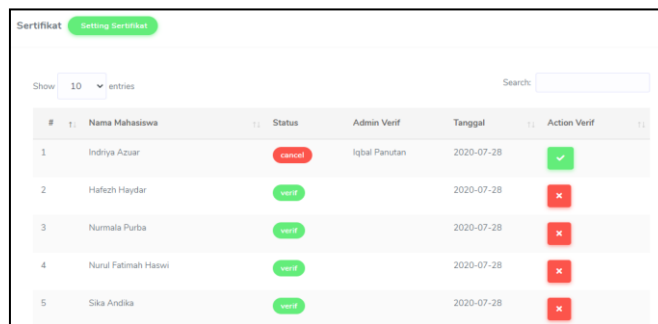


figure 12. Certificate Verification Page

- 8) The Activity Data Page is used to add, edit, and delete activity data displayed on the system’s main page, which is managed by the admin and operator. The user interface for the activity data page can be seen in the Figure 13.



Figure 13. Activity Data Page

- 9) Admin Data Page is used to manage the data of admins and operators involved in the system. In addition, this page displays a list of all registered admins and operators within the system. The user interface for the admin data page can be seen in the Figure 14.

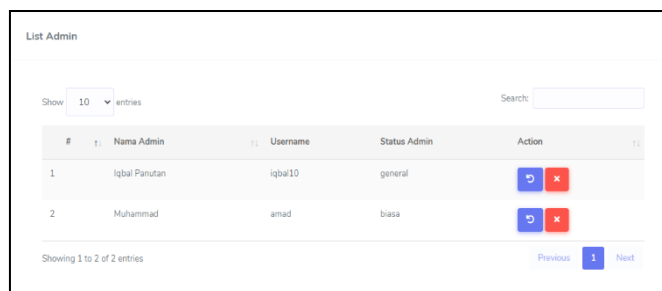


Figure 14. Admin Data Page

- 10) The Student Clustering Page displays the results of the clustering process for new students using the K-Means method. The data shown on this page includes the student's name, study program, report card score, national exam score, admission pathway, and the final cluster result. The user interface for the student clustering page can be seen in the Figure 15.

#	Nama	Prodi	Nilai Raport	UN	Jalur Seleksi	Cluster Akhir
1	Kevin Nuryadi Syahputra	Teknologi Rekayasa Manufaktur	89	95	PMDK	Pintar
2	Muhammad Razi Kumar	Teknologi Konstruksi Bangunan Gedung	83	92	PMDK	Pintar
3	Muhammad Fathur Syidky	Teknologi Konstruksi Bangunan Gedung	87	90	PMDK	Pintar
4	Muhammad Ayisha	Teknologi Konstruksi Bangunan Gedung	89	88	Bidikmisi	Pintar
5	Farra Meidaffa	Teknologi Konstruksi Bangunan Gedung	91	95	Bidikmisi	Pintar

Figure 15. Student Clustering Page

#### - Calculation Using Weka Software

Weka is an open-source data mining application based on Java. It was originally developed by the University of Waikato in New Zealand before later becoming part of Pentaho. Weka consists of a collection of machine learning algorithms that can be used to perform generalization or formulation from a set of sampled data.

#### 1) New Student Data

In the student data clustering process, the variables used are Study Program (Prodi), National Exam Score (UN), and Report Card Score (Raport). These variables produce 30 clusters based on the data of 1,188 new students from the 2019 academic year at Politeknik Negeri Lhokseumawe. The data was processed and converted into an ARFF file format so it could be analyzed using the Weka software. The ARFF data format can be seen in the Figure 16.

```
@RELATION wk3
@ATTRIBUTE PRODI      REAL
@ATTRIBUTE RAPORT     REAL
@ATTRIBUTE UN         REAL

@DATA
17,83,77
17,87,81
17,86,71
17,78,84
17,87,74
18,67,74
18,89,79
18,74,64
18,90,84
18,87,77
18,67,77
18,87,79
```

Figure 16. New Student Data

- 2) Results of Calculation Using Weka Software can be seen in the Figure 17.

```
Class attribute: class
Classes to Clusters:

 0 1 2 3 4 5 6 <-- assigned to cluster
26 23 25 20 25 27 24 | C1
25 24 29 28 26 16 22 | C2
31 24 29 18 32 21 15 | C3
29 14 29 18 32 29 19 | C4
26 26 27 18 34 20 19 | C5
28 22 25 24 34 19 17 | C6
20 17 29 24 38 20 21 | C7

Cluster 0 <-- C6
Cluster 1 <-- C5
Cluster 2 <-- C3
Cluster 3 <-- C2
Cluster 4 <-- C7
Cluster 5 <-- C4
Cluster 6 <-- C1

Incorrectly clustered instances :      986.0      82.9966 %
```

Figure 17. clustering results

- 3) Visualization results shown in the Figure 18.

4)

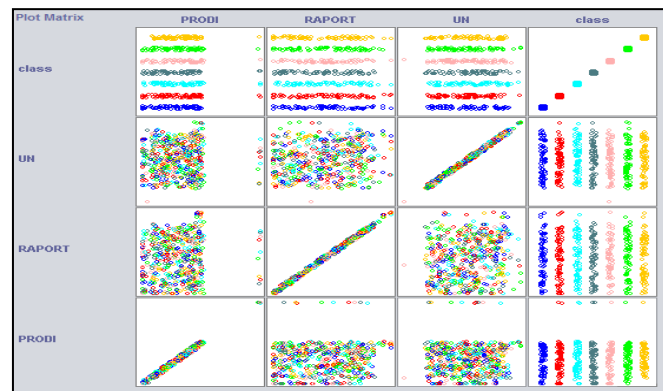


Figure 18. clustering visualization results

## 4. Conclusion

Based on the results and discussion presented in the previous chapter, the conclusions of this final project can be summarized as follows :

1. The information system was designed using the Data Flow Diagram (DFD) design technique and has been successfully implemented according to the intended design.
2. The system was developed using the Waterfall model research methodology and has been tested using both Black Box and White Box testing methods.
3. The information system implementing the K-Means method is capable of generating registration cards, certificates, activity data, and performing clustering on new student data effectively.

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