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Clustering of Customer Complaints from PDAM Kota Binjai Using the K-Means Method

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Abstract
PDAM Tirtasari Binjai City is a public service institution that has a monopoly on water supply in Binjai City. The predicate as a metropolitan city, illustrates that Binjai City is a city with dense industry and trade. In this study, discusses how to handle customer complaints of PDAM Binjai City to provide satisfaction to customers. The research method used in this study is K-Means which aims to describe the quality of service for handling customer complaints at PDAM Kota Binjai in increasing customer satisfaction. The informant determination technique carried out by the researcher is using the Clustering K-Means method.

Keywords: Data_Mining, K-Means Clustering, Customer Complaints.

INTRODUCTION

PDAM is a regional company as a means of providing clean water which is broadcast and monitored by the executive and regional legislatures. The modern managed drinking water company has existed since the Dutch colonial era in the 1920s under the name Waterleiding (water slide) while the Japanese occupation was called Suido Syo.

Based on data from the Binjai City PDAM from 2018-2020, it can ensure that the types of complaints in the Binjai area vary, the results are various kinds of complaints, both in terms of complaint factors and types of customers.With the PDAM in charge of serving facilities and infrastructure cases in Binjai City, the method of grouping data like this is with data mining. In data grouping research conducted using the Clustering K-Means method, a data mining technology design is needed to maximize the performance of PDAM Binjai City to find out various types of complaints that exist in the community in Binjai City.

RESEARCH METHODS

Based on research conducted by Diky Randyka Kurniawan, Budi Susetyo, Erwin Hermawan (2019) discussing the spatial analysis of K-Means Clustering the distribution of customer complaints of PDAM Tirta Pakuan based on WebGIS. From this research, the researcher conducts research with appropriate data so that it will produce what is needed by the user. Where all can identify problems with the K-Means method so that the research has conclusions that can help and provide valid results that are examined by the author.

Data mining according to Turban, et al (2005, p. 3) is a term used to describe the discovery of knowledge in the database. Data mining is a process that uses statistical, mathematical, artificial intelligence, and machine learning techniques to extract and identify useful information and related knowledge from large databases.

According to Larose (2005), data mining is an analysis of reviewing data sets to find unexpected relationships and summarizing data in a different way than before, which is understandable and useful for data owners. Data mining is related to other fields of science, such as database systems, data warehousing, statistics, machine learning, information retrieval, and high-

level computing. In addition, data mining is supported by science such as neural networks, pattern recognition, spatial and analysis, image databases, signal processing.

1. Data mining as a process in knowledge discovery in data (KDD)

The processes in KDD are:

1) Data selection
   Selection (selection) of data from a set of operational data needs to be done before the stage of extracting information in KDD begins. Selected data used for the data mining process is stored in a file, separate from the operational database.
2) . Pre-processing / cleaning
   Before the data mining process can be carried out, it is necessary to carry out a cleaning process on the data that is the focus of KDD. The cleaning process includes, among others, removing duplicate data, checking for inconsistent data, and correcting errors in data.
3) Transformation
   Coding is a transformation process on the data that has been selected, so that the data is suitable for the data mining process. The coding process in KDD is a creative process and is highly dependent on the type or pattern of information to be searched in the database.
4) Data mining
   Data mining is the process of looking for interesting patterns or information in selected data using certain techniques or methods. Techniques, methods, or algorithms in data mining vary widely. The selection of the right method or algorithm is highly dependent on the overall objectives and process of KDD.
5) Interpretation / evaluation
   The pattern of information generated from the data mining process needs to be displayed in a form that is easily understood by interested parties. This stage is part of the KDD process called interpretation. This stage includes checking whether the pattern or information found contradicts pre-existing facts or hypotheses. (Fayyad, 1996).

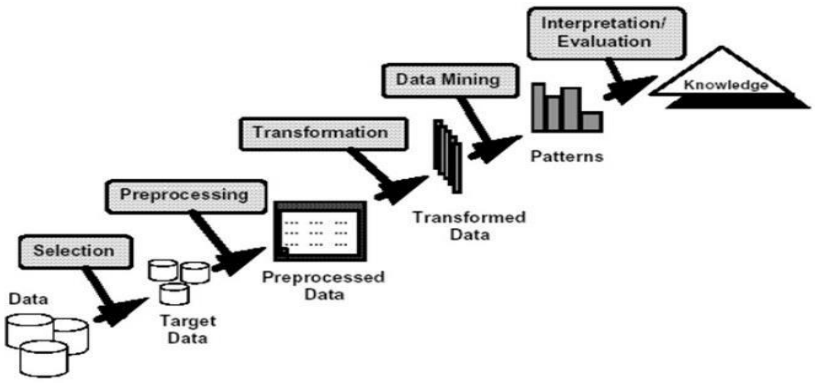

Figure 1 Knowledge Discovery in Data (KDD)

2. Understanding the Clustering Method

According to Widodo (2013:9) "Clustering or classification is a method used to divide data sets into several groups based on previously determined similarities".

The purpose of this data clustering is to minimize the objective function set in the clustering process, which generally tries to minimize variations within a cluster. And minimize the variation between clusters. Broadly speaking, there are several methods of data classification. The choice of clustering

method depends on the type of data and the purpose of the clustering itself.

RESULTS AND DISCUSSION

After making observations the author will identify problems that are pleasing to the customer complaints of PDAM Binjai City, in this case the author tries to provide solutions to the problems found in PDAM Tirtasari Binjai City. and evaluate problems. Obstacles that occur and the expected needs so that obstacles can be repaired quickly and efficiently.

1. Display Login Menu

In the login menu display, the function is to call the initial display containing the main form, namely Username and Password, then the results of the display will be as below:

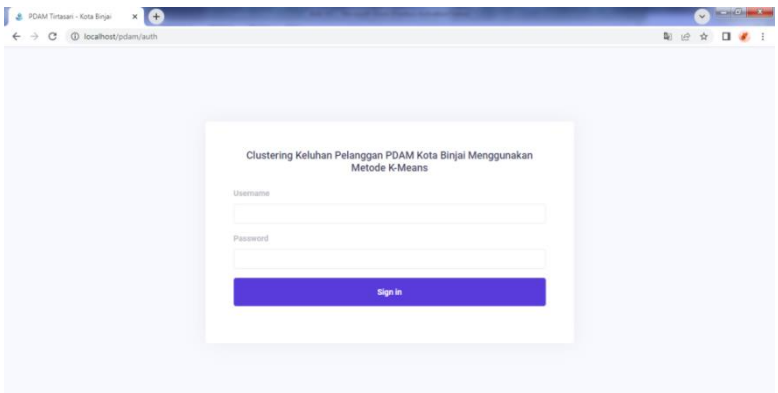

Figure 3 Display Login Menu

2. Home Menu Display

This view contains the buttons used in the system process, the determination of the centroid, and the clustering process. The menu contains menus, namely Main Menu, Home, Data (Customer Complaints, Complaint Type, Customer Group, District), Centroid, Results, Cluster.

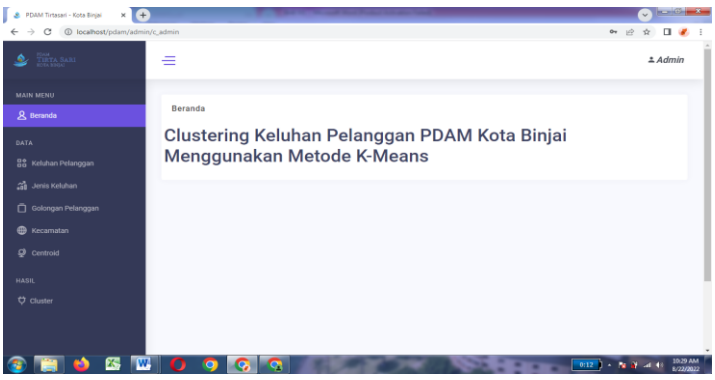

Figure 4 Display Menu Home

3. Home Menu Display

The Customer Complaint Type display contains No, Complaint ID, Customer Name, District, Complaint Type, Customer Group, Action.

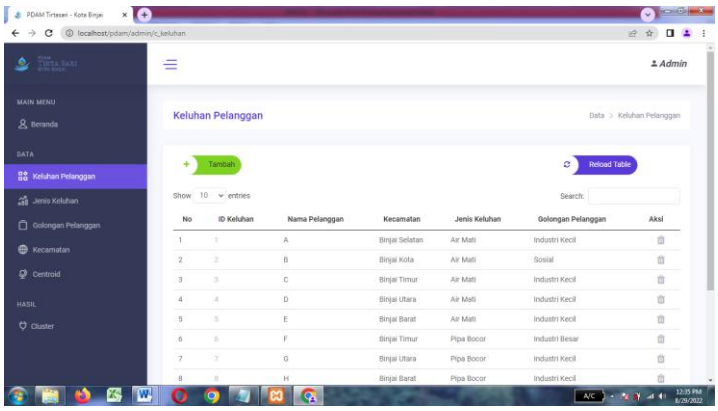

Figure 5 Display of Customer Complaint Data

4. Display of Customer Complaint Type

The Customer Complaint Type display contains No, Complaint Type ID, Complaint Type, Customer Complaint Type Points, Action.

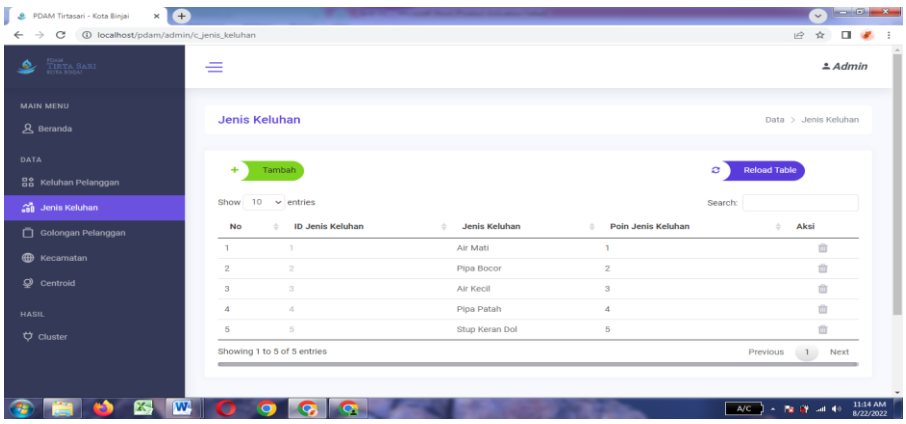

Figure 6 Display Types of Complaints

5. Display of Customer Class

In the Customer Group Type display contains No, Complaint Type ID, Customer Class, Complaint Type Points, Action.

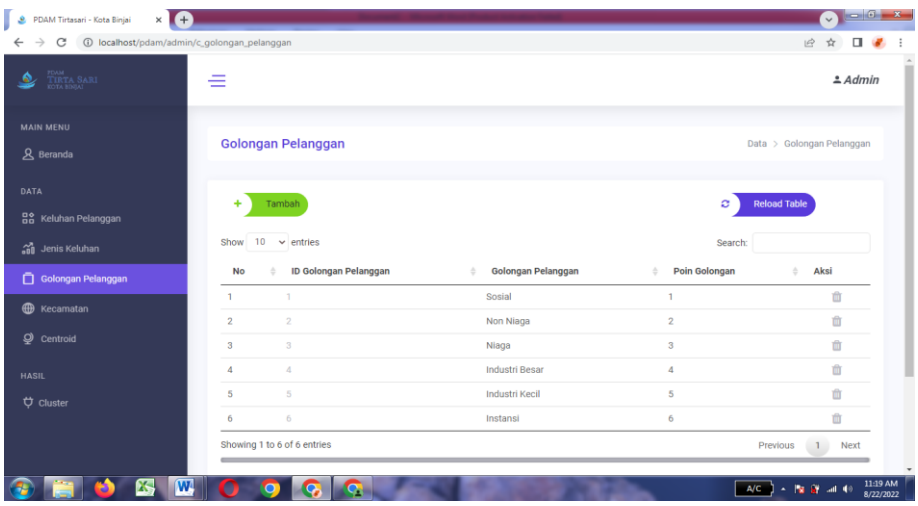

Figure 7 Display of Customer Class

6. Display District Menu

In the District menu display contains No, ID Type of Complaint, District, Points Type of Complaint, Action

.

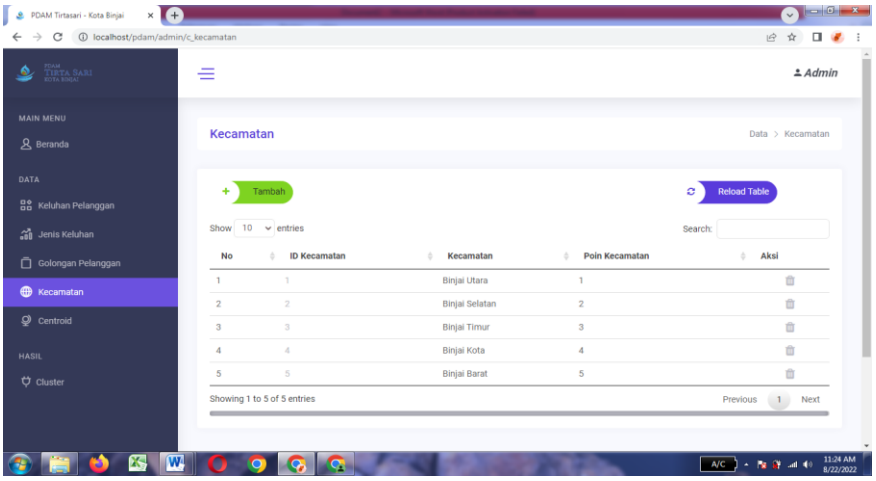

Figure 8 Display District Menu

7. Centroid Menu Display

This Centroid menu display displays data such as C11, C12, C13, C21, C22, C23, C31, C32, C33.

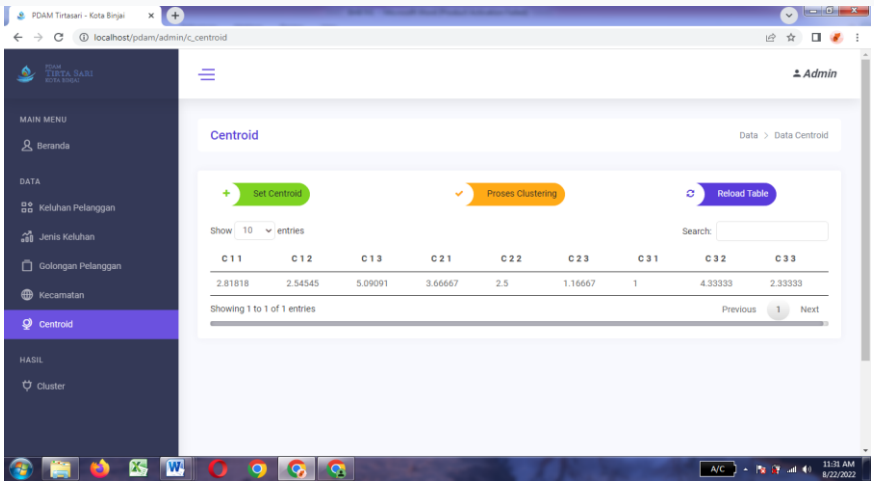

Figure 9 Display of the Centroid Menu

8. Cluster Menu Display

In the Customer Group Type display contains No, Complaint ID, Customer Name, District, Complaint Type, Customer Group, Cluster

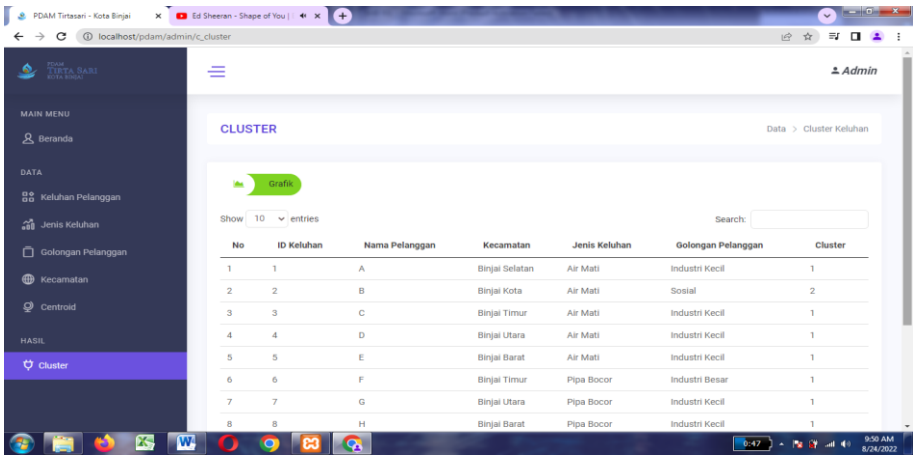

Figure 10 Display Cluster Menu

Implementasi

This section describes the results of the data mining calculation trials in programming the K-Means algorithm using PHP that has been created. This trial aims to determine whether the system created can run well and in accordance with the system design that has been discussed in the previous chapter.

In the manual trial, this program uses a program that has been made, each feature or menu in the program is explained one by one in full:

1. The initial stage the user is asked to turn on the start button (apache and mysql) on the XAMPP Control Panel as below:

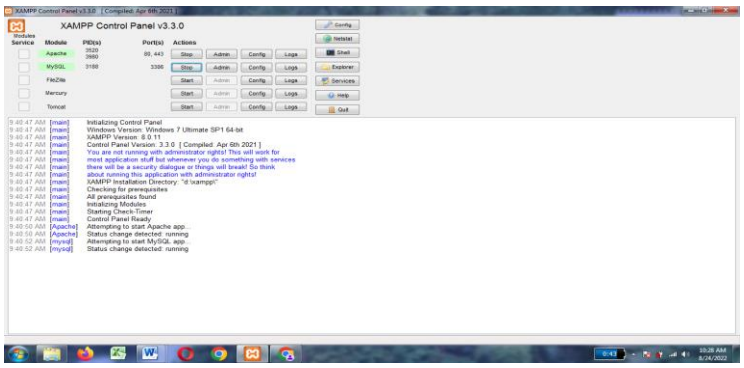

Figure 11 Early Stage

2. The second stage the user is asked to enter a user name and password to enter the system, as shown below:

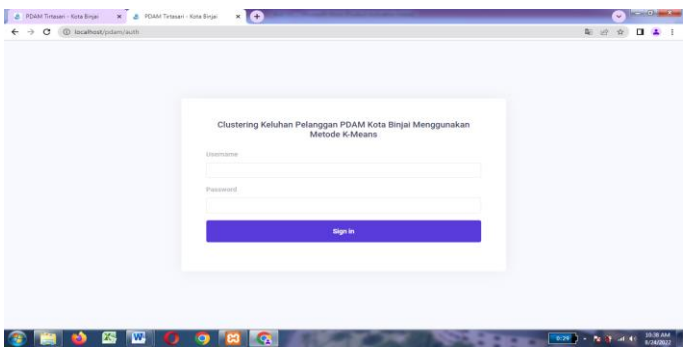

Figure 12 Second Stage

3. The third stage after logging in, the main menu will appear which will display other menus on the system as below:

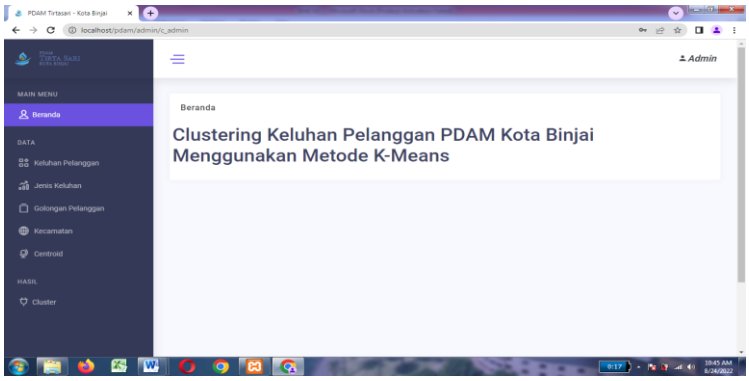

Figure 13 Third Stage

4. The first fourth step is to add participants for customer complaint data by clicking on customer complaints:

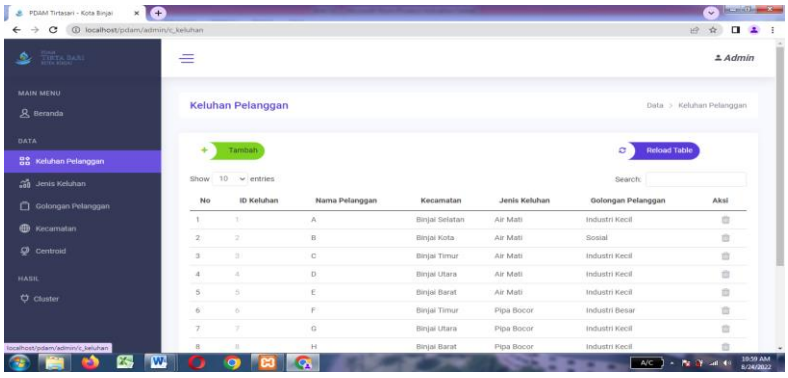

Figure 14 Fourth Stage

After clicking, the following menu will appear:

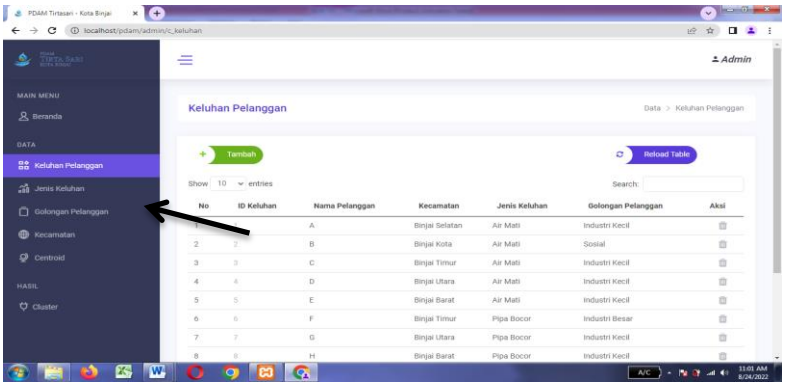

Figure 15 Stages of Entering the Customer Complaints Participants Menu

To add participants, click the Add button, a display like this will appear:

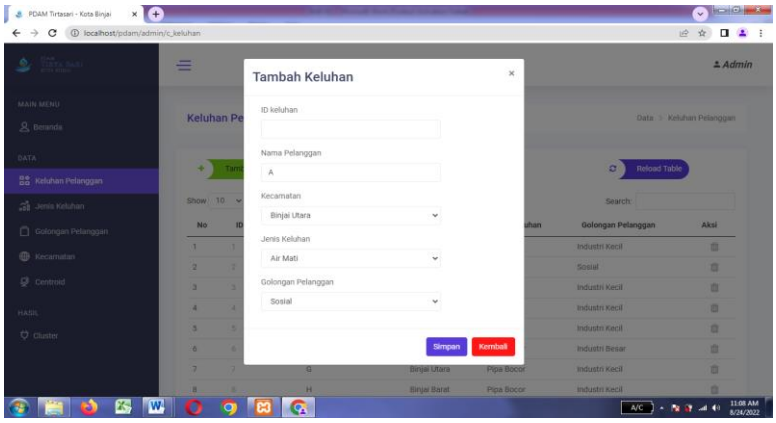

Figure 16 Stages of Adding Participant Menu

If you have filled in every data, if you want to save then click save if not then click again.

5. The fifth step is to click on the Complaint Type menu on the previous main menu and a display like this will appear:

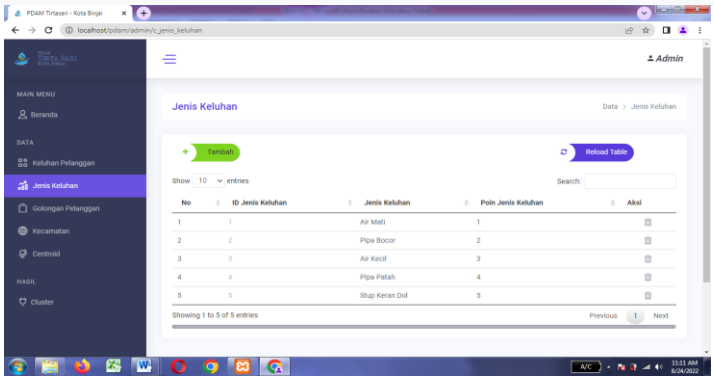

Figure 17 Fifth Stage

After clicking, the following menu will appear:

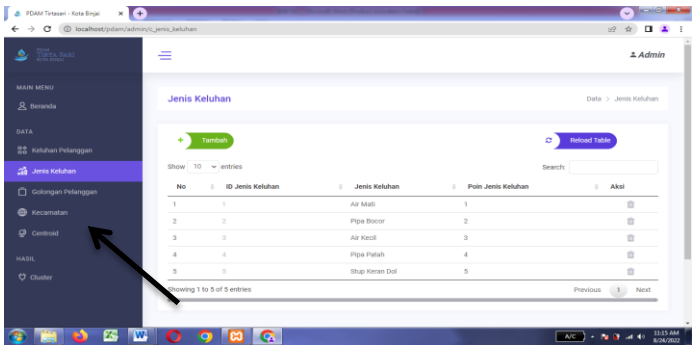

Figure 18 Steps for Entering the Participants Menu Type of Complaint

To add participants, click the Add button, a display like this will appear:

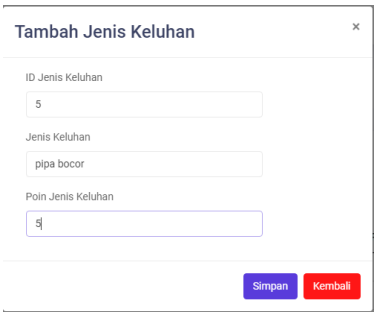

Figure 19 Steps to Add Participant Menu

If you have filled in every data, if you want to save then click save if not then click again.

6. In the sixth stage, click on the Customer Group menu on the previous main menu and a display like this will appear:

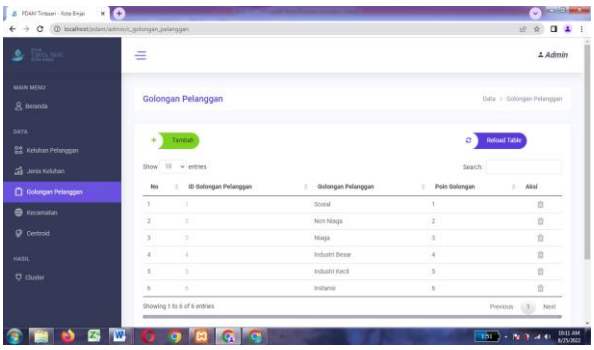

Figure 20 Sixth Stage

After clicking, the following menu will appear:

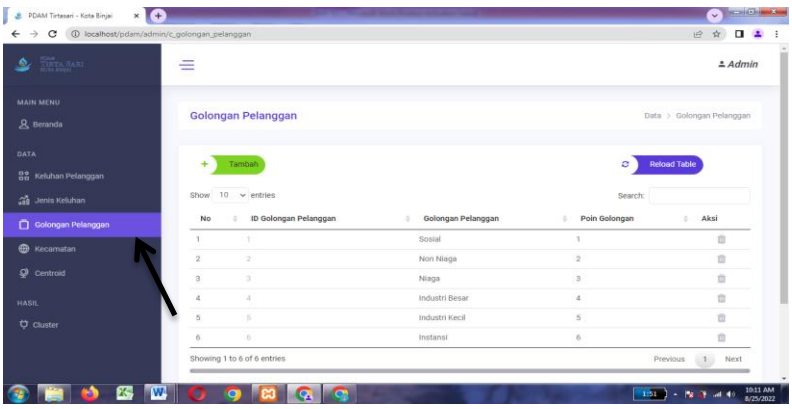

Figure 21 The Stage of Entering the Customer Group Participant Menu

To add participants, click the Add button, a display like this will appear:

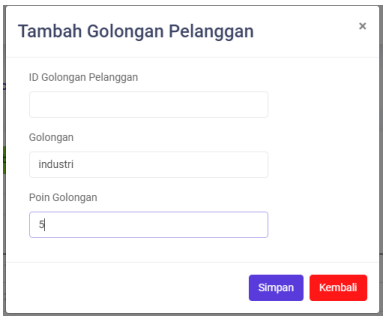

Figure 22 Steps to Add Participant Menu

If you have filled in every data, if you want to save then click save if not then click back.

7. In the seventh stage, click on the District menu on the previous main menu and a display like this will appear:

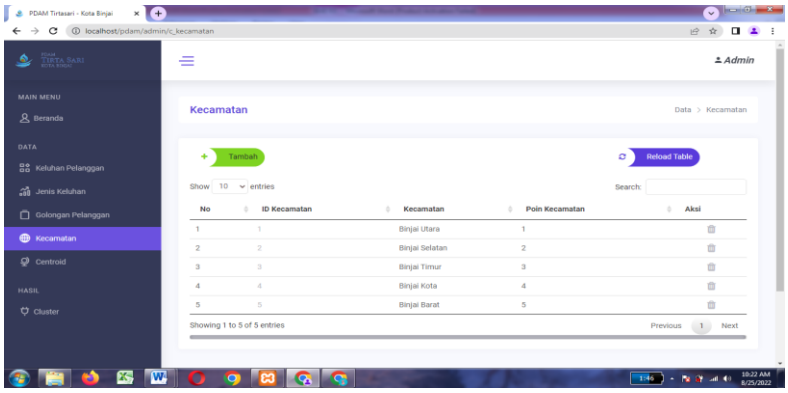

Figure 23 Seventh Stage

After clicking, a menu will appear as shown below:

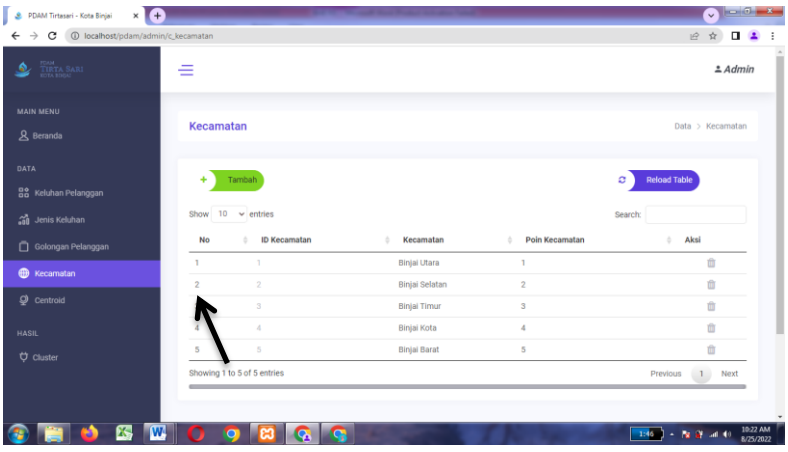

Figure 24 Stages of Entering the District Menu

To add participants, click the Add button, a display like this will appear:

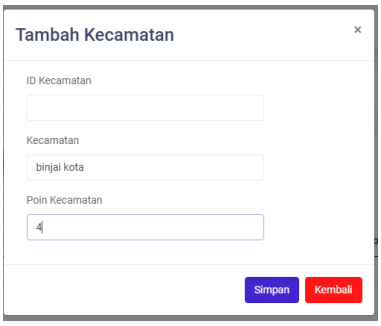

Figure 25 Stages of Adding Participant Menu

If you have filled in every data, if you want to save then click save if not then click again.

8. The eighth stage click on the Centroid menu on the previous main menu then a display like

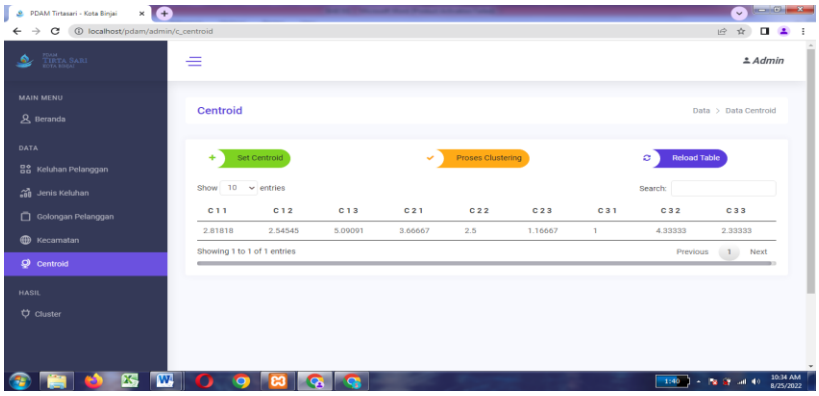

Figure 26 Eighth Stage

To set the Centroid click the Centroid button it will appear like this:

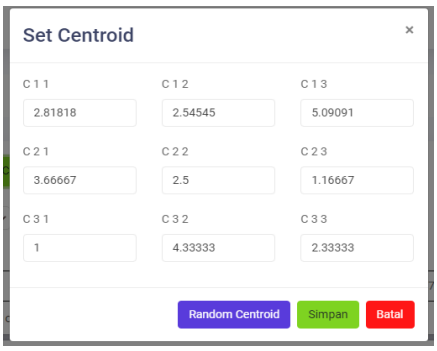

Figure 27 Steps to Add Set-Centroid Menu

To add a centroid, click set-Centroid, the Centroid is automatically filled and then save, after the Centroid is set, click the Cluster process to process the Cluster, wait a few minutes until the process is complete.

9. The ninth stage after the Cluster process on the Centroid menu, enter the Cluster menu to see the results of the Cluster and its groups as shown:

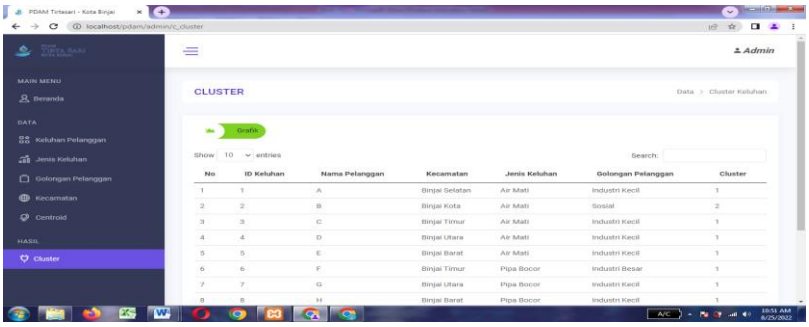

Figure 27 The Ninth Stage

To add a graph click the graph on the Cluster it will appear below:

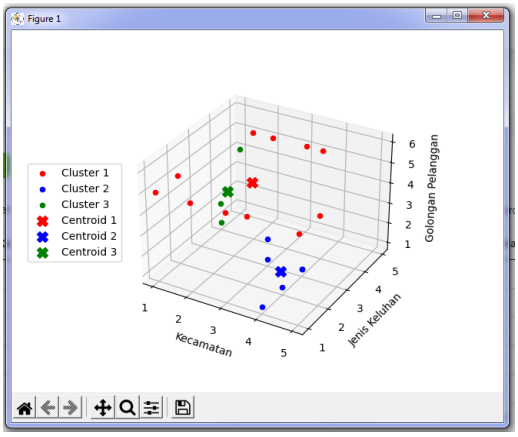

Figure 28 Graph Results

After all the processes are complete, you can see the output or results of each customer complaint, type:

complaints, customer groups, and districts used in the statistical form will appear image as below:

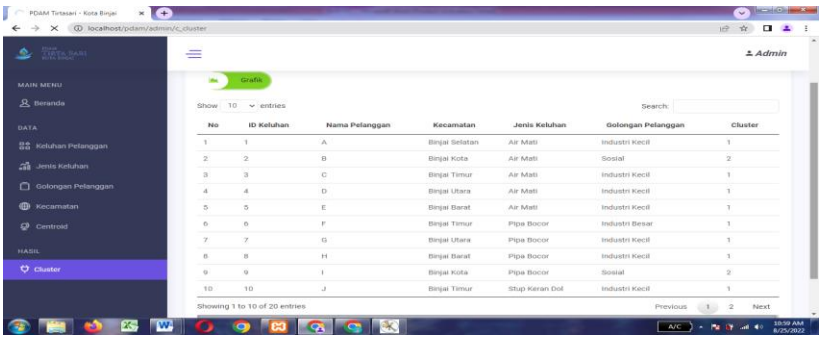

Figure 29 Program Output Results

CONCLUSION

It can be tested using the Clustering Method with the K-Means algorithm, it can be seen groups of Complaint Types, Customer Types, Districts from the Binjai City area. From the tests carried out using the Clustering method with the K-Means algorithm, it can be seen that the customer complaints of PDAM Binjai City have a Customer Complaints group, 9Types of Customers, and Districts. In the program can help users in classifying customer complaints PDAM Kota Binjai. The results of the data that have been described previously that for Centroid 1 It can be seen that in Cluster 1 in group 1, namely South Binjai District, with the type of complaint Air Kecil, with the type of customer, namely small industries (Coffee Shop, Nasi Warung, Kedai), can it is known that in cluster 2 in group 2, namely East Binjai, with the type of complaint Leaking Pipe, with the type of customer namely Social (Orphanage Homes, Nursing Homes, Rehabilitation, Places of Worship), it can be seen that in Cluster 3 in group 3, namely East Binjai , with the type of complaint of Dead Water, with the type of customer, namely Large Industrial Banks (Orphanage Homes, Nursing Homes, Rehabilitation, Places of Worship).

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