Geographic Information System Mapping and Management of Child with the Highest Nutritional Potential in Prabumulih City Using K-Means Clustering Method
(Case Study: Prabumulih City Health Office)

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ABSTRACT

Malnutrition is one of the diseases that Indonesia is worried about, not only a burden on the state, but also a burden on the family. Of course this is also a concern of the local government, including Prabumulih City. Based on a report from the family health and community nutrition section at the Prabumulih City Health Office, in 2019 the number of cases of malnutrition in children under five reached 1%. And to maximize health monitoring in toddlers so that they are not potentially bad, clustering is carried out using the K-Means algorithm which aims to provide information for the parties involved in decision making. The system development method used is eXtreme Programming (XP). The data used is a recap of data on toddlers with bad potential from 2018 - 2020. This study resulted in clusters (groups) of bad disaster distribution areas with a level of C1 for areas with high nutritional potential, C2 for areas with moderate nutrition levels. potential, for C3 for areas of low potential malnutrition.

Keywords: *Malnutrition, Clustering, k-means, eXtreme Programming.*

1. INTRODUCTION

In Indonesia, malnutrition still occurs in many children under five, for example, malnutrition. This problem is one of the benchmarks for the quality of human resources. This problem occurs during the life cycle starting from the stomach (fetus), infants, children, adults and the elderly. If from the beginning of their toddler life they do not understand the importance of nutritional intake, then this can interfere with the development and progress of the brain and make their immune system strong.

Nutrition is an important requirement for the growth and development of toddlers because healthy food causes toddlers to grow well and normally, if the food they get is bad, the toddler's development can be hampered. In some areas, there are still many toddlers who still don't get enough attention from their parents on the nutritional intake of toddlers. Therefore, it is necessary to map toddlers to find out which areas are still malnourished.

In 2019, there were 173 stunting toddlers in Prabumulih City or 1.0%. The Puskesmas that reported the most stunting cases was Pasar Puskesmas, which was 77 stunting cases. The category of underweight and very thin toddlers is the nutritional status based on the weight index for height (BB/TB). In 2019, underweight children under five in Prabumulih City were reported as 47 toddlers or 0.3%. The Puskesmas that reported the most cases of underweight toddlers was Pasar Puskesmas, which was 28 thin toddlers.

Based on the description above, to maximize the monitoring of under-five health so that it does not have a bad potential, health mapping is needed. The implementation of this mapping uses the K-means clustering method which is useful for classifying malnourished children under five.

This Geographic Information System is a system specifically designed to assist the delivery of information and locations that are prone to cases of under-five malnutrition in Prabumulih City.

Therefore, we raised this issue as our research with the title "geographic information system mapping and children management with the highest potential of malnutrition in prabumulih city with k-means clustering method **(case study: prabumulih office)"**.

2. DESCRIPTION OF STUDY AREA

There is no application that is able to classify the Based on the background described above, it can be said that the existing problems are:

1. There is no application that is able to classify the data for the highest malnutrition toddlers, making it easier for the Prabumulih City government to pay special attention to areas that have the highest clusters.

2. Lack of public awareness of cases of under-fives that may be bad in their own environment.

Based on the above background, finally conclude the formulation of the problem in this application, namely: "How to create a Geographic Information System for Mapping and Grouping Toddlers with the Highest Bad Probability in Prabumulih City Using the K-Means Clustering Method.

2.1. Geographic Information System

Geographic Information System is a system that combines 2 graphic data and text data that will display a geographical description of the earth's surface in digital form.

Geographic Information System is a description of the earth's geographic surface in digital form on a computer-based information system used to obtain information [1].

Geographical Information System (GIS) is a component system that contains hardware, software, geographic data, and human resources that carry out plans to enter, store, update, manage, manipulate, integrate, analyze , and displaying data in geographic-based information [2].

2.2. K-Means

K-Means is a non-hierarchical clustering method that has a relatively faster computation time [3].

K-Means is one of the algorithms in data mining that can be used to group/cluster data [4]. K-Means algorithm is a distance-based method that will divide data into several clusters to be able to have larger data [5].

2.3. Clustering

Clustering is a method of grouping based on size and similarity [4]. Clustering is a process that can be used in an organization to process a data mining. Clustering is a number of homogeneous clusters with one model that can perform the segmentation process of a heterogeneous population [6].

So it can be concluded that Clustering is grouping data mining into the same cluster without being based on certain data classes.

3. DEVELOPMENT PROCEDURES

3.1. Stages of Problem Formulation

This stage is the process of formulating the problem and limiting the problem to be studied. This is necessary so that researchers are more direct in making this geographic information system so that what is done does not go out of the limits that have been previously set.

3.2. Stages of Data Collection

At the data collection stage, the author refers to the opinion of Supriyono [7], where this opinion explains the data collection method which divides the method into two types, namely:

1. Primary data is a source of research data obtained directly from the original source or the first party. Primary data collection was done by using observation and interview methods.

2. Secondary data is research data obtained by researchers indirectly, through intermediary media. Here the author takes data indirectly, namely by looking for information through research journals, supporting books, and other document source.

3.3. Stages of Research Design

System development is through several stages starting from identifying the problem after being identified it will determine the point of the problem, after that later determine data collection in the form of interviews and field observations and literature studies. Then analyzed using the development method of Analysis, Design, Coding and Testing. Thus it will enter into the test results. This is done to provide learning, and media information about mapping areas for toddlers with potential malnutrition.

One of the research and development models developed by Supriyono [7] are two data collection methods, namely primary data and secondary data:
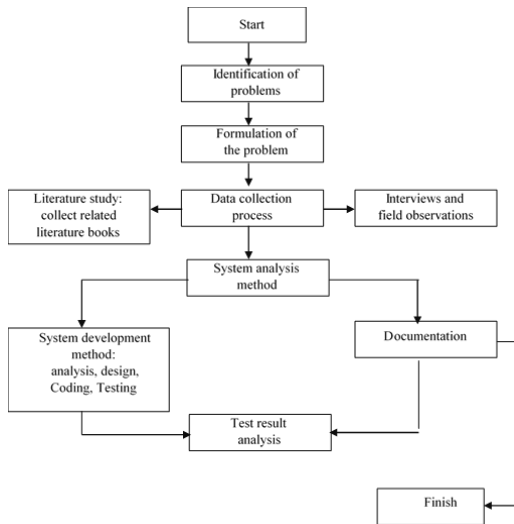
Figure 1 Research Design Stage

4. RESULT AND DISCUSSION

4.1. *Define Stages*

The define stage aims to define the terms of product development that are in accordance with the needs of the user. The define stage is carried out activities aimed at analyzing development needs, as well as defining product development requirements that are in accordance with user needs. Activities included in the define stage are curriculum analysis, interviews, goal formulation, media needs specifications, media development models and software specifications. This define stage can be various stages, namely: Curriculum Analysis, Interview, Preparing Materials, Goal Formulation, Media Needs Specification, Learning Media Development Model, Software Specification. The supporting components in making this video are. Hardware :

1. Laptop : hp Intel Inside
   Operating System : Windows 10 64 byte
   Hard disk Internal : SSD 225 GB
   Hard disk external : Storage 500GB
2. Software :
   Microsoft Office : Used to make a final project report
   Sublime Text : Used to write programming scripts in System
   MySQL : Used to perform database design of the System.
   Microsoft Visio 2016 : Used to design the design of the System program
   XAMPP : Supports various operating systems.

4.2. *Design Stages*

At the design stage, we will create an initial product or product design which in this case is the design or concept creation of a mapping geographic information system. Included in this stage is the design of the login page, the design of the home page of the head of service, the home page of the health office admin, the homepage of the puskesmas admin page as well as the design of the clustering calculation and the design of the page visualization of the map from the calculation. Creating an image or asset, and the display design that will be used in making map visualization
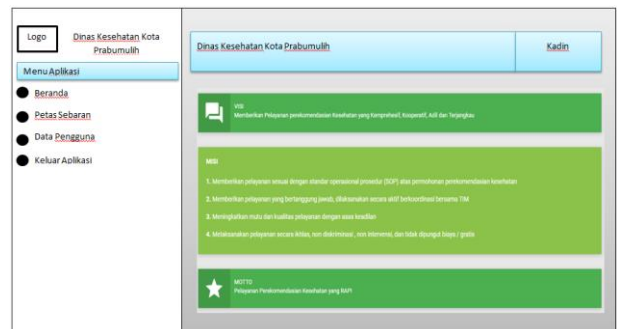

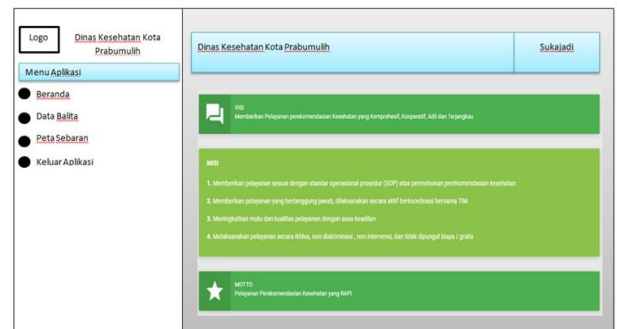**Figure 2** Login Page Display

Figure 3 Head of Service Home page view

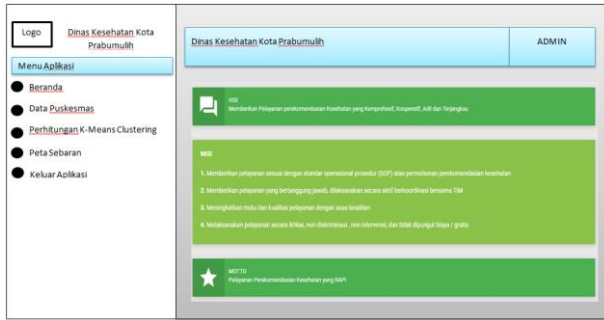**Figure 4** Health Center Admin Home page view

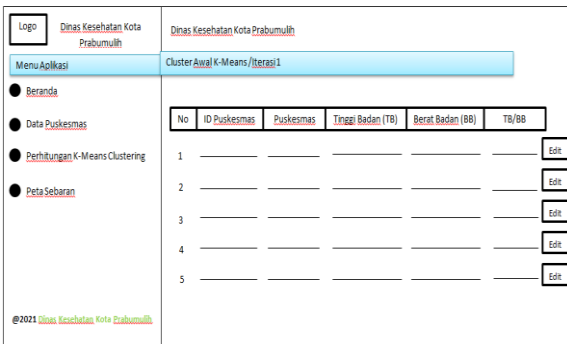**Figure 5** Display of the Home page of the Health Office Admin

Figure 6 K-Means Clustering Calculation Page View

Figure 7 Map of Distribution of Malnourished Toddlers

4.3. Development Stages

After carrying out the design stage and testing the program that has been run, the next step is to develop it or it can also be adjusted to the implementation stage of the design that has been made previously with reference to the concepts that have been made at the previous point. But there is something that is no less important in this development is user feasibility test. The feasibility test here is that before the mapping system is used by the user, we will test it first so that when it is used there are no problems, in this case usually a demo of how to use this system will be carried out to users who will use it. After that we will ask the user's opinion about the system that has been created. It aims to find out the shortcomings or difficulties of the system that has been created.

Table 1. Tests carried out by the Admin of the Health Service

No	Tested function	Test Method	Expected page	Test result
1	Login	Admin enter username and password	Admin enters the health center data processing home page	Succeed
2	View Health Center Data	Select the health center data menu	Admin sees health center data	Succeed
3	Adding health center data	Select the health center data, then click add	Admin can add puskesmas data	Succeed
4	Editing health center data	Select the health center data, then click edit	Admin can edit puskesmas data	Succeed
5	See the calculation of k-means clustering	Select and click k-means clustering calculation	Admin can see the calculation of K-Means Clustering	Succeed
6	Viewing the Distribution Map	Select and click the distribution map	Admin can see the point of potential malnutrition	Succeed
7	Logout	Select Exit Menu	Admin Log out of the system	Succeed

Table 2. Tests conducted by the Health Center Admin

| No	Tested function	Test Method	Expected page	Test result
1	Login	Admin enter username and password	Admin enters the health center data processing home page	Succeed
2	Viewing Toddler Data	Select the Toddler data menu	Admin sees Toddler data	Succeed
3	Add toddler data	Select toddler data, then click add	Admin can add toddler data	Succeed
4	Editing toddler data	Select toddler data, then click edit	Admin can edit toddler data	Succeed
5	Viewing the Distribution Map	Select and click the distribution map	Admin can see the point of potential malnutrition	Succeed
6	Logout	Select Exit Menu	Admin Log out of the system	Succeed

Table 3. Tests conducted by the Head of Service

No	Tested function	Test Method	Expected page	Test result
1	Login	Admin enter username and password	Admin enters the toddler data processing home page	Succeed
2	Manage user data	Select menu user data	Admin view user data	Succeed
3	Add user data	Select user data then click add	Admin can add user data	Succeed
4	Viewing the Distribution Map	Select and click the distribution map	Admin can see the point of potential malnutrition	Succeed

| 5 | Logout | Select Exit Menu | Admin Log out of the system | Succeed |

4.4. Stages of Dessemination

This stage is the final stage of the system. The socialization stage or it can also be called the publication stage, where this publication stage will be carried out to the general public to pay attention to the nutrition of children under five through data and visualization of the distribution map of malnourished children under five.
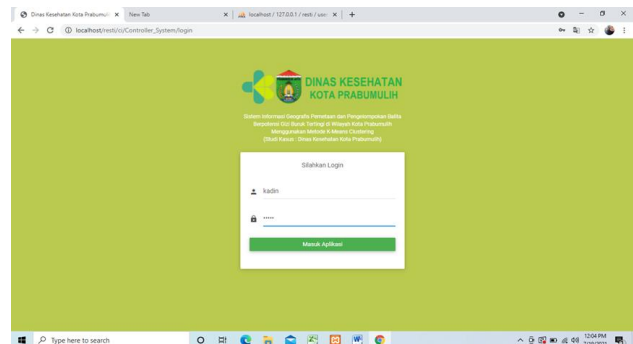
Figure 8 Displays a login page that can be used

5. CONCLUSION

The data used is a recap of data on toddlers with bad potential from 2018 - 2020. This study resulted in clusters (groups) of bad disaster distribution areas with a level of C1 for areas with high nutritional potential, C2 for areas with moderate nutrition levels. potential, for C3 for areas of low potential malnutrition.

REFERENCES

[1] R. M, Awangga, 2019, Pengantar Sistem Informasi Geografis Berbasiskan Open Source. Bandung: Alfabeta, cv

[2] A. Adil, 2017, Sistem Informasi Geografis. Yogyakarta: ANDI.

[3] I, Chandra, 2021, Penerapan Algoritma K-Means dalam Mengelompokkan Balita yang Mengalami Gizi Buruk Menurut Provinsi. Jurnal Teknologi Informasi dan Rekayasa Komputer, 2(1), 30-38..

[4] D,T, Hapsari, 2017, Penerapan Algoritma K-Means pada Kualitas Gizi Bayi di Indonesia. Seminar Nasional Teknologi Informasi dan Multimedia ISSN:2302-3805, 1-79

[5] Wahyudi et al, 2020, Data Mining : Penerapan Algoritma K-Means Clustering dan K-Medoids Clustering. Yayasan Kita Menulis

[7] R.A, Supriyono, R.A. 2018. Akuntansi Keperilakuan. Yogyakarta: Gadjah Mada University Press 15

[6] D, Jollyta, W, Ramdhan, & M, Zarlis, 2020, Konsep Data Mining dan Penerapan. Yogyakarta: DEEPUBLISH