

GEOGRAPHIC INFORMATION SYSTEM MONITORING THE SPREAD OF DISEASE IN THE DEPARTMENT OF HEALTH AND POPULATION CONTROL CITY KB SAWAHLUNTO

Desiatadila¹, Tati Harihayati Mardzuki²

^{1,2}Information Engineering - University Computer Indonesia

Jl. Dipatiukur 112-114 Bandung

E-mail: desiatadila@gmail.com¹, tati.harihayati@email.unikom.ac.id²

ABSTRACT

Control of Population Health Office and KB Sawahlunto is one SKPD (Local Rank Unit) which is responsible for organizing the field of health development priorities of public health services, while in charge of the program is the Disease Prevention and Control Section. Each month the Department of Health briefed by 6 health centers of 37 villages in Sawahlunto. This report is a kind of monitoring Section Head of Disease Control and Prevention each month about any disease that is happening in the city of Sawahlunto with the number of people and villages which are affected by the disease, but this time the report was shaped beam figures in the table making the Section Head had difficulty in monitoring because it does not describe rural areas affected by the disease, as well as Section Head of difficulty in determining the action taken to the village where the first by handling perpenyakit for next month. The criteria in making remedial action is diabetic populations, status, rate of spread and healthy population, resulting in a village where the highest cases of a disease. Results from Black Box testing, User Acceptance Test (UAT),

Keywords : Geographic information systems, monitoring the spread of the disease, Sawahlunto.

1. PRELIMINARY

Control Health Office of Population and family planning Sawahlunto city is one SKPD (Local Rank Unit) which is responsible for organizing the field of health development priorities of public health services, prevention and control of diseases. Control of Population Health Office and KB Sawahlunto have three (3) areas, namely Public Health Disease Control Prevention, field Promotion Services Health Resources and Control Population and family planning fields. The fields are responsible for the public health development program is the field of Public Health Disease Prevention and Control, Disease Prevention and Control section.

The results of the interview with Ms. Sriwaresky Ismal as Section Head of Disease Control and Prevention states that the Department of Health Control of Population and Family Planning oversees

the six public health centers of 37 villages in Sawahlunto, puskesmas is PHC Silungkang, Lunto, Kolok, Kampung Teleng, Talawi, and Rivers Durian. Each month, this clinic gives results *surveillance* the health department in order to monitor the spread of the disease. Results of disease reports from six health centers have obtained information that there is still a disease that is a problem such as DBD, malaria, diare and ISPA, this is due to DBD and Malaria the Department is conducting free programs of DBD and malaria, while diseases Ispa and Diare became the highest disease in the city of Sawahlunto. Based on the results of monitoring, status is obtained based on the number of patients and the number of cases taking place in a village, if the patient is number 1-30 with 1-6 cases are number village including moderate status, if it is in number > 31, and the case of > 6 villages then be in status photo Secure.

The results of this monitoring resulted in the disease status is used to determine the operational steps with the highest number of patients, the rate of deployment and status, with the result that the health department can disseminate to the region next month based on previous cases into those areas in the disease. Socialization is done to inform the public to be more vigilant for the disease is going their village so that later no increase in cases or deaths, because based on reports from previous years obtained deaths, and therefore based on the results of monitoring in order to do an act of socialization. Socialization can be a means of disease prevention and drug delivery.

Therefore the Health Department requires information systems to explain the overview of the area which should be an act of socialization terebih first. With this information the system can easily map the territory, boundary spread of disease and disease status sector in a village in the form of spatial data, then the solution is to build a Geographic Information System Monitoring Spread of Disease Control at the Health Office of Population and family planning Sawahlunto.

2. BASIC THEORY

2.1 Geographic Information Systems

Geographic information systems (GIS) or Geographic information system (GIS) always have a different understanding and different, but basically a geographic information system is a system-based

computer that has the ability to menangani a referenced data geographic including data input , data management, and data output. Output data is a geographic view based on input data that have been and can be used as reference in making decisions related to geography. [1]

2.1.1 Spatial Data

Reference [2] Explaining that spatial data is the data which is a geographical description on representations of objects on earth. Spatial data is generally derived from a map which contains interpretations and projections of all phenomena on earth. Sapasial data has two types, namely vector and raster.

1. Vector Data Model

Vector data model is a data model that is most widely used, the model is based on the point (points) with the coordinates (x, y) to build a spatial object. Objects built again divided into three parts, namely [2] :

- a. Point (point)
- b. Line (line)
- c. Area (polygon)

2. Raster data model

Raster data also called grid cells) is the data generated from remote sensing systems [2]. In this data, geographic objects show a side room bentu earth in the form of a pixel (picture element) that form a grid or a plot generated from remote sensing, and on this data by the size of the pixel depends on the resolution [2].

2.1.2 Non-Spatial Data

Non-spatial data or attribute data is data that represent aspects of the description of the phenomenon being modeled that covers the items and properties, so that the information submitted will be more diverse, non-spatial data also store attributes of the appearance of the surface of the earth such as soil that has the attributes of texture, depth and so forth. Non-spatial data / attributes stored in the form of lines (records) and columns (fields), an example of non-spatial data are: District Name, Address government offices, website address, name of the mountain[2],

2.2 Monitoring

Some experts researchers stated that the function of monitoring weight have the same value to the function of planning. Conor (1974) states that success in achieving a goal, half of which is determined by the predetermined plan and the other half is determined by monitoring the function itself. In general, management stressed the importance of these two functions, namely planning and monitoring monitoring. Kegiatan intended to determine the suitability and appropriateness of activities undertaken with the plans that have been prepared.

Broadly speaking, monitoring serves as a case for the repair activities that deviate from the rules or plans have been made, fix the abuse of rules and

resources, and to strive for attainable goals as effectively and efficiently as possible. Based on its usefulness, William Travers Jerome monitoring classify into eight kinds, as follows [3]:

1. Monitoring is used to maintain and standardize the implementation of a plan in order to improve efficiency and reduce the cost of implementation of the program.
2. Monitoring is used serves to determine the suitability of the quality of the results with interest the results users with the ability of existing executive power.
3. Monitoring is used to determine the accuracy of the delegation of tasks and responsibilities that must be done by staff or subordinates.
4. Monitoring is used to measure the appearance of executing tasks.
5. Monitoring is used to determine the accuracy of the implementation of the planning program.
6. Monitoring is used to determine a wide range of plans and compliance with the resources owned by an organization or institution.
7. Monitoring is used to create a motivational involvement of the implementers.

There are several purposes of monitoring that can be viewed from several aspects, for example in terms of the object and the subject being monitored, and the results of the monitoring process itself. The purpose of monitoring is (Amsler et al, 2009) as follows:

1. Assess whether the activities are carried out in accordance with the plan.
2. Providing high value will be accurate data for monitoring offenders.
3. Identifying the issues that arise that can be resolved immediately.
4. Cultivate positive motivation and work habits.
5. Assess whether the work patterns and management used was appropriate for the purpose mrncapai activities.
6. Knowing the connection between the events in order to obtain a measure of progress.
7. Linngkungan adjust with the changing activities, without deviating from the goal.

2.3 Dashboard

dashboard a tool to read the status of the page, displaying the results presentation in the form of graphs, dashboards are essentially useful in making decisions that reflect to see and evaluate the results and improve the information contained in a company. Dashboard is also useful to see what impact the most influential on the outcome of input data through a graphic display. [4]

2.4.1 Key Performance Indicator

Key Performance Indicator (KPI) is a set of standards on the most important aspects of performance to determine an organization's success in the present and future [5].

2.5 Decision Support System

Decision support system is an interactive computer-based system that allows users in the decision to use the data and various models untu solve unstructured problems. [6]

2.5.1 Simple Additive Weighting (SAW)

Simple Additive weighting method (SAW) is a weighted summation method. The basic concept of the system is looking for a weighted summation of a performance rating on alternatives that have been through the prescribed criteria, resulting in the normalization of the decision matrix (X) as a comparison with other alternatives to the formula: [6]

$$r_{ij} = \begin{cases} \frac{X_{ij}}{\text{Max } X_{ij}} & \text{If } j \text{ is the profit attribute (benefit)} \\ \frac{\text{Min } X_{ij}}{X_{ij}} & \text{If } j \text{ is the cost attribute (cost)} \end{cases} \dots \{1\}$$

Where :

r_{ij} = Performance rating ternormalisasi

Max_{ij} = Maximum value of each row and column

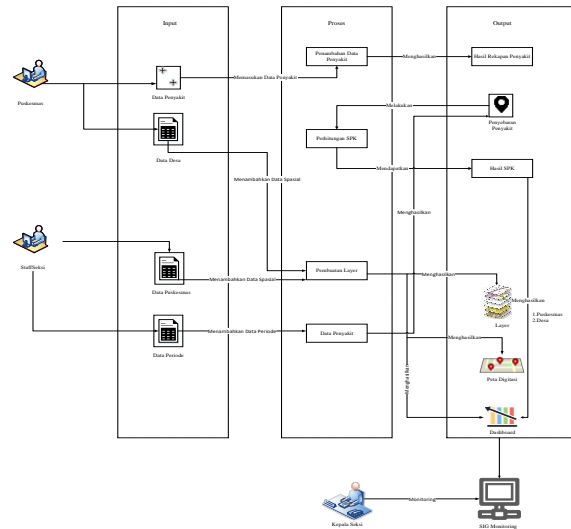
Min_{ij} = Minimum value of each row and column

X_{ij} = Rows and columns of a matrix

3. CONTENTS OF RESEARCH

3.1 Analysis of Geographic Information Systems

Geographic information systems analysis is the stage where we know what kind of a geographic information system that will be created. Analysis of geographic information systems can be seen in Figure 1.







Picture 1. Analysis of Geographic Information Systems

3.2 Analysis of Spatial Data

Spatial data in applications to be built include health centers, villages, and villages affected by the disease. Spatial data are distinguished by shape and different colors to make the information displayed more obvious. Analysis of spatial data can be seen in Table 1.

Table 1. Analysis of Spatial Data

No .	Monitoring indicators	Descriptio n	Spatial Data	Example
1	PHC	Silungkang	Polygon	
		Lunto	Polygon	
		Kolak	Polygon	
		Kampung teleng	Polygon	
		Talawi	Polygon	
		Durian	Polygon	
2	Village	The village green menandakn status safe disease	Polygon	
		Menandakn status village green with moderate disease	Polygon	
		The village green menandakn status unsafe disease	Polygon	

No	Monitoring indicators	Description	Spatial Data	Example
3	Villages affected by the disease	The coordinates of the spread of dengue disease	Point	
		Coordinates of the point spread of malaria	Point	
		Coordinates of the point spread of the disease Diarrhea	Point	
		The coordinates of the spread of respiratory diseases	Point	

3.3 Non-Spatial Data Analysis

Non-spatial data used to build geographic information system monitoring the spread of the disease in the health department of population control and family planning Sawahlunto more details can be seen in Table 2.

Table 2. Non-Spatial Data Analysis

No.	Name	Description	Attribute
1	Type of disease	Contains the data spread of the disease in the village of Sawahlunto	id_desa, id_penyakit, nama_desa, jumlah_penduduk, jumlah_penderita
2	Total population	Contains data existing population sector in the village in Sawahlunto	id_desa, jumlah_penduduk
3	number of Patients	Contains data on the number of patients who contract the disease	jumlah_penderita, kode_penyakit

3.4 Analysis Dashboard

Dashboard is a medium for presenting information, solutions for information needs.

3.4.1 Analysis of Objectives and KPI Dashboard Design

Here is the analysis of objective and KPI Dashboard design to be made can be seen in Table 3.

Table 2. Objective analysis and KPI

Primary objective	Sub - Objective	KPI	Target
Monitoring Spread of Disease	Improve the effectiveness of the monitoring of the spread of disease	The spread of the disease for a total disease	37
		The spread of the disease with the number of patients	37

Primary objective	Sub - Objective	KPI	Target
		The spread of the disease by the time the report	12

3.4.2 Graph

The graph on the dashboard will be used to see the visualization and implies a comparison against the spread of the disease can be seen in Figure 2.

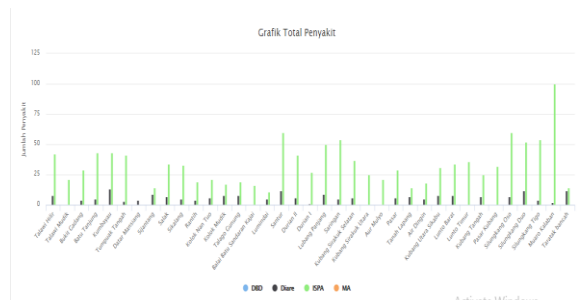


Figure 2, graph Disease

3.5 Analysis of Data Disease

Disease data analysis aims to analyze the spread of the disease annually in the city of Sawahlunto. The data is the data dissemination villages affected by the disease, and disease data were used as the sample is data illness in 2017 can be seen in Table 4.

Table 4. Fertilizer Demand PD Barokah

No	Puskesmas	Nama Desa	DBD	Malaria	Diare	ISPA	Jumlah Penderita
1	Talawi	Talawi Hilir	12	1	45	300	4.136
2		Talawi Mudik	2	0	78	276	3.073
3		Bukit Gadang	1	0	77	465	1.490
4		Bukit Tanjung	1	0	53	321	2.083
5		Kumbayau	2	0	44	423	1.751
6		Tumpuk Tengah	2	0	53	313	2.153
7		Datar Mansiang	0	0	75	50	198
8		Sijantang	2	0	33	247	1.199
9		Salak	1	0	31	317	1.394
10		Sikalang	0	0	42	411	1.782
11		Ranrih	1	0	65	198	677
12	Kolok	Kolok Nan Tuo	14	0	36	326	1.306
13		Kolok Mudik	1	0	78	406	1.370
14		Talago Gumung	11	0	54	281	1.793
15		BHS Kajai	0	0	66	187	692
16		Lumindai	3	0	44	453	2.754
17	Sei Durian	Sannur	12	0	55	971	3955
18		Durian II	8	0	47	732	2.380
19		Durian I	21	0	72	777	2.504
20		Lubang Panjang	12	0	15	642	1.436
21	Saringan	8	0	43	825	1.846	
22	Kampung Teleng	Kubang Sirakuk Selatan	0	0	20	356	1.117
23		Kubang Sirakuk Utara	5	0	32	243	970
24		Aur Mulyo	4	0	20	311	1.111
25		Pasar	3	0	32	318	1.538
26		Tanah Lapang	4	0	21	503	1.387
27		Air Dingin	3	0	27	322	1.083
28		Sikabu	4	0	26	370	1.209
29	Lumto	Lumto Barat	0	0	132	531	1.462
30		Lumto Timur	2	0	47	849	1.529
31		Kubang Tangah	4	0	98	733	1.600
32		Pasar Kubang	1	0	22	987	1.074
33	Silungkang	Silungkang Oso	1	0	78	811	1.542
34		Silungkang Duo	1	0	61	819	1.423
35		Silungkang Tigo	4	0	33	760	2.366
36		Muaro Kalaban	19	1	21	713	5.664
37		Taratak bancal	1	0	17	239	693

Table 5. Data Analysis Disease Status

Disease	Sufferers	Case	Status	Conclusion
DBD	0	0	Secure	No socialization
	1-10	1-5	medium	Socialization
	>11	>6	Not Secure	Advanced socialization
Malaria	0	0	Secure	No socialization
	1-10	1-5	medium	Socialization
	>11	>6	Not Secure	Advanced socialization
Diare	1-10	1-10	Secure	No socialization
	11-30	11-20	medium	Socialization
	>31	>21	Not Secure	Advanced socialization
ISPA	1-10	1-10	Secure	No socialization
	11-30	11-20	medium	Socialization
	>31	>21	Not Secure	Advanced socialization

The next step is to look at the analysis of determination of the action. Here is the flow of the determination of the action:

1. Criteria of Weighting

Table 6. The criteria and weighting

Criteria	Inner weight (%)	Weight in decimals	Attribute
Sufferers (C1)	25%	0.25	Benefit
Status (C2)	15%	0.15	Benefit
Level of Spread (C3)	40%	0.4	Benefit
Healthy residents (C4)	20%	0.20	Cost

2. Criteria for Hazard Level

Table 7. Criteria Level Danger

Disease	Sufferers	Case	Status	Conclusion	Value
DBD	0	0	Secure	No socialization	1
	1-10	1-5	medium	Socialization	2
	>11	>6	Not Secure	Advanced socialization	3
Malaria	0	0	Secure	No socialization	1
	1-10	1-5	medium	Socialization	2
	>11	>6	Not Secure	Advanced socialization	3
Diare	1-10	1-10	Secure	No socialization	1
	11-30	11-20	medium	Socialization	2
	>31	>21	Not Secure	Advanced socialization	3
ISPA	1-10	1-10	Secure	No socialization	1
	11-30	11-20	medium	Socialization	2

>31	>21	Not Secure	Advanced socialization	3
-----	-----	------------	------------------------	---

3. Criteria Level of Deployment

Table 8. Criteria Level of Deployment

Case	Level of Spread	Value	Case
0-10	Lambat	1	0-10
11-20	Sedang	2	11-20
>21	Cepat Menular	3	>21

4. Alternatives and criteria

Table 9. Alternative and Criteria

Alternative/ Criteria	Sufferers	Status	Level of Spread	Healthy residents
Batu Tanjung	15	2	2	2068
Saringan	22	3	3	1842
Kolok Mudik	12	2	1	1358
Silungkang Oso	14	2	2	1528

The calculation of the value of preference for each alternative:

$$v_i = \sum_{j=1}^n w_j r_{ij} \quad (2)$$

Information :

V_i = Rank for each alternative

W_j = The weight of each criteria

R_{ij} = The performance rating ternormalisasi

5. Results normalization and weighting

Table 10. SAW Calculation

Weight (W_j)	0.25	0.15	0.4	0.20
Alternative/ Criteria	Sufferers	Status	Level of Spread	Healthy residents
Batu Tanjung	0.68	0.67	0.67	0.65
Saringan	1	1	1	0.73
Kolok Mudik	0.55	0.67	0.33	1
Silungkang Oso	0.64	0.67	0.67	0.88

6. Final Results of calculation SAW

Table 11. Results

Village	Results
Batu Tanjung	0.79
Saringan	0.94
Kolok Mudik	0.57
Silungkang Oso	0.70

From the calculation of SPK Simple Additive weighting method (SAW), from the calculation seeking the best alternative from four villages, the village Sieve village is highest for Diare. So the Section Head of Disease Prevention and Control act of socialization / education for the rural Diare Filter.

3.6 Analysis Database

Analyzing the data base can use the Entity Relationship Diagram (ERD). ERD is a technique to describe the information required in the system and the relationship between these data. Here ERD on a system that can be seen in Figure 3.

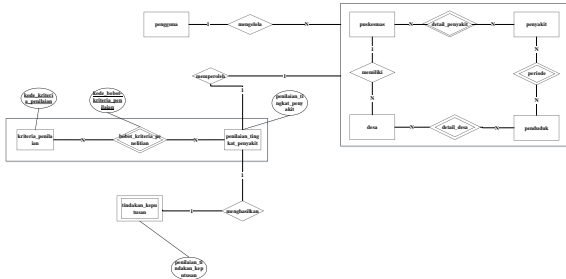


Figure 3. Relationship Entity Monitoring Geographic Information System Diagram Spreading Disease Control Health Office of Population and KB Sawahlunto

3.7 Diagram Context

Context diagram is a diagram illustrating the relationship between external entities with which the system will be built. Can be seen in Figure 4.

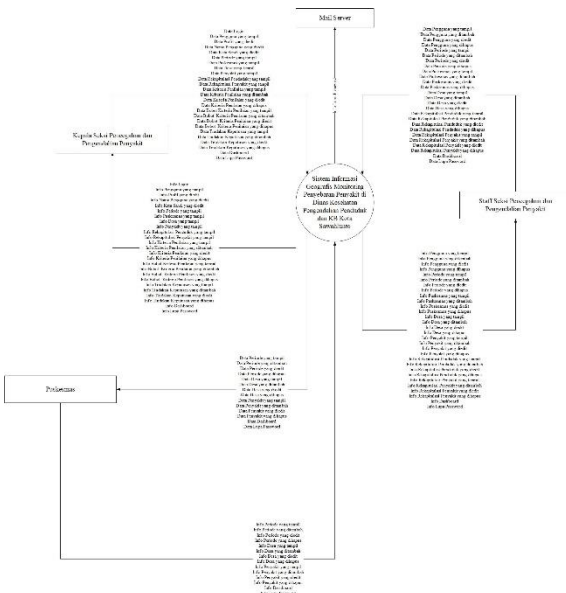


Figure 4. Context Diagram Deployment Monitoring Geographic Information Systems in Health Department Disease Control Population and Family Planning Sawahlunto

3.7 DFD Level 1

Data Flow Diagram Level 1 Monitoring Geographic Information System Spread Disease Control Health Office Sawahlunto Population and family planning can be seen in Figure Figure 5.

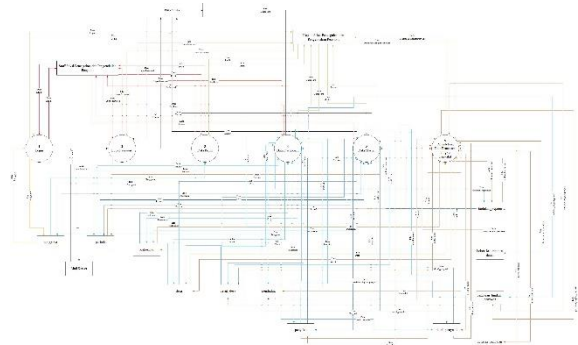


Figure 5. DFD Level 1 Monitoring Geographic Information System Spread Disease Control Health Office of Population and KB Sawahlunto

3.8 Relationship Diagram

Relationship diagram is a database design. This design is a relationship for each table in the database. Geographic information system relationship diagram is shown in Figure 6.

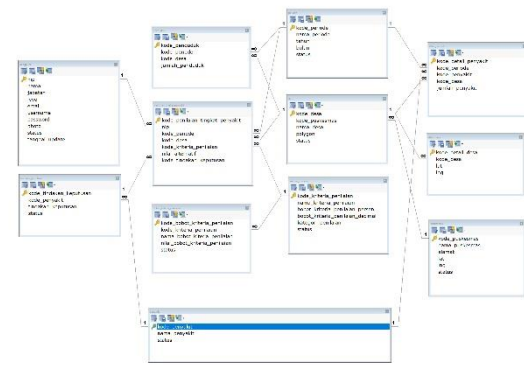


Figure 6. Relationship Diagram Deployment Monitoring Geographic Information Systems in Health Department Disease Control Population and Family Planning Sawahlunto

3.7 Interface

Interface design log on geographic information systems Monitoring Spread of Disease Control at the Health Office of Population and family planning Sawahlunto can be seen in Figure 7.

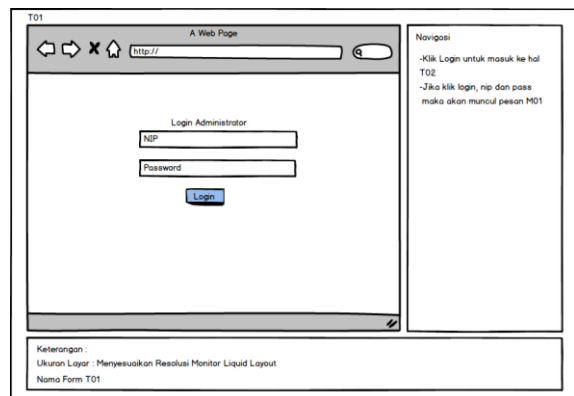


Figure 7. Interface Design of Geographic Information System Log Monitoring Spread Disease

3.7.1 Interface Home Staff Community Health Center

Interface design homepage health center in geographic information systems Monitoring Spread of Disease Control at the Health Office of Population and family planning Sawahlunto can be seen in Figure 8.

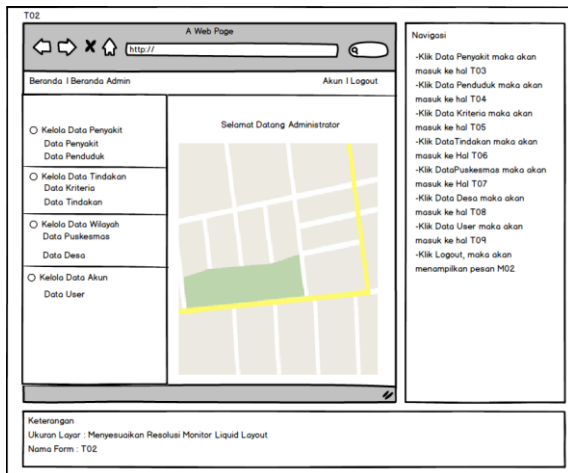


Figure 8. Interface Design Home Staff Monitoring Health Center of Geographic Information Systems in Health Department Spreading Disease Control Population and Family Planning Sawahlunto

3.7.2 Interface Home Staff Disease Prevention and Control Section

Marketing homepage interface design on sistem geographic information Monitoring Spread Disease Control Health Office of Population and family planning Sawahlunto can be seen in Figure 9.

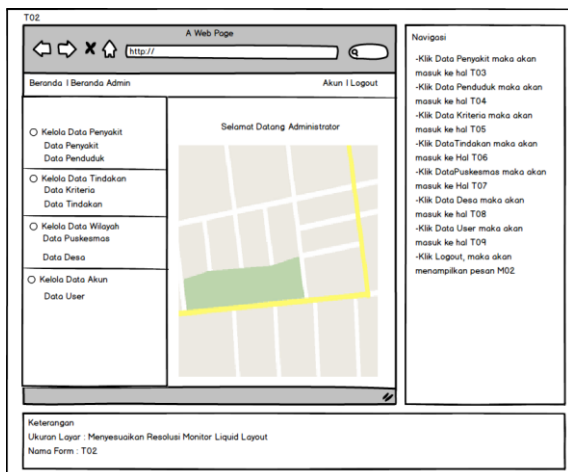


Figure 9. Interface Design Home Section Staff Deployment Monitoring Geographic Information Systems in Health Department Disease Control Population and Family Planning Sawahlunto

3.7.3 Interface Home Section Head of Disease Prevention and Control

Interface design homepage section chief in geographic information systems Monitoring Spread of Disease Control at the Health Office of Population and family planning Sawahlunto can be seen in Figure 10.

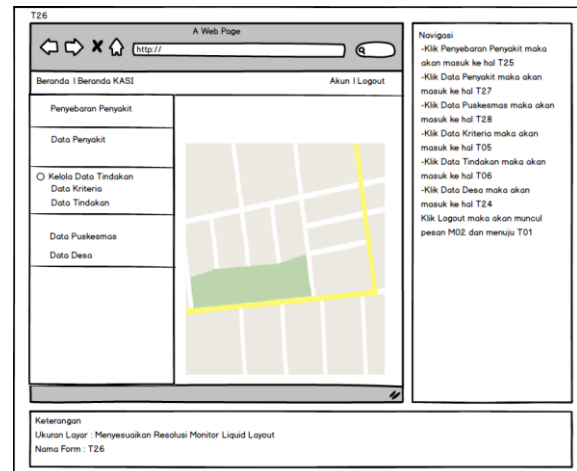


Figure 10. Interface Design Home Section Head of Geographic Information System Monitoring Spread of Disease Control at the Health Office of Population and KB Sawahlunto

3.8 Procedural Design

Design is a stage doing drafting procedural flow diagram of the whole system works in a geographic information system that will be created. Here is a procedural design such as login, additional data, alteration of data, deletion of data, search data.

3.8.1 Procedural Login

Procedural login is the process used to be entered into the system. Procedural login can be seen in Figure 12.

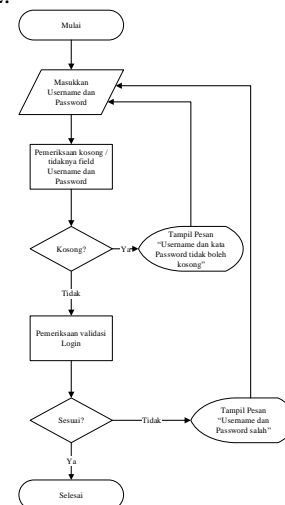


Figure 12. procedural Login

3.8.2 Procedural Data Additions

Procedural addition of data is a process used to perform additional data. additional procedural data can be seen in Figure 13.

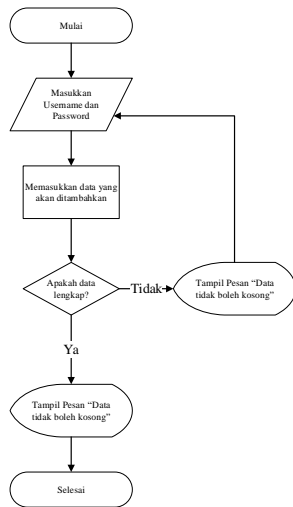


Figure 13. Procedural Data Additions

3.8.3 Determining Procedural SPK

Procedural SPK-determination is a process used to make the determination of the action. SPK determination procedural data can be seen in Figure 14.



Figure 14. Determination procedural SPK

3.9 Testing System

examination to assess whether the system has been built according to the needs and to evaluate the advantages of the new system with the old one. The activities in this phase that Blackbox testing, UAT testing.

3.9.1 Conclusion Blackbox Testing

Based on the results of system testing has been done can be concluded that the geographic information system Monitoring Spread Disease Control Health Office of Population and family planning Sawahlunto has produced the expected output.

3.9.2 Conclusion UAT Testing

Based on test results Acceptance User Test (UAT) has been done on geographic information systems Monitoring Spread of Disease Control at the Health Office of Population and family planning Sawahlunto, it can be concluded that the system can be used by end users.

Conclusion 3.9.3 User Acceptance

Based on test results, it is concluded that the geographic information system Monitoring Spread of Disease in the Health Service Control Population and Family Planning Sawahlunto is in accordance with the expected goals are to assist the Head of Section in identifying problems spread of the disease and the determination of an act of socialization to the village with the disease highs next month

4. COVER

4.1 Conclusion

Based on test results obtained from studies conducted in the preparation of this thesis as well as referring to the purpose of the study that has been created, it can be concluded that:

1. The system can help the Section Head of Disease Prevention and Control to monitor the spread of the disease to achieve a healthy city program.
2. The system can help the Section Head of Disease Prevention and Control in decision-making actions which villages socialization first by action.

4.2 Recommendations

Based on the results that have been achieved in building a Geographic Information System Monitoring Spread of Disease Control at the Health Office of Population and family planning Sawahlunto still has shortcomings, therefore it is advisable to add things that can complement the future, including:

1. Geographic Information Systems are built to be developed in also features a display that can be made more attractive and more user friendly.

2. Geographic Information Systems are built in the future in a more simplified menu display, and for validation not too much.

BIBLIOGRAPHY

- [1] SD Dr. Indarto, *Geographic Information Systems*, Yogyakarta, 2013.
- [2] E. Prahasta, *Geographic Information Systems Basic Concepts (Perspective Geodesy and Geomatics)* Bandung: Bandung Informatics, 2014.
- [3] DKK Casely, *Project Monitoring and Evaluation in Agriculture*, Baltimore: John Hopkins, 1987.
- [4] S. Malik, *Enterprise Dashboard Design and Best Practice for IT*, New Jersey: John Wiley & Sons, Inc., 2005.
- [5] D. Parmenter, *Key Performance Indicators: Developing, Implementing, and Using Winning KPIs*, New Jersey: John Wiley & Sons, Inc., 2007.
- [6] E. Sri, "Decision Support System Design for Admission Scholarship by the method of SAW (Simple Additive weighting)".