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Geographic Information System for Data Collection of Cooperatives and Small Medium Enterprises in East Sumba

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Abstract

Cooperatives and Small and Medium Enterprises (SMEs) are important pillars in the regional economy, with the Cooperatives and SMEs Office playing a crucial role in its development. East Sumba Regency has great potential, but the lack of comprehensive spatial data hinders the making of appropriate policies. This research aims to develop a Geographic Information System (GIS) for data collection of Cooperatives and SMEs in East Sumba Regency. The research method used is waterfall, with data collection through interviews, observations, and documentation. The results are in the form of maps and information on the distribution of Cooperatives and SMEs. It is hoped that this GIS can assist the Agency and Regional Governments in formulating policies that are right on target, as well as supporting training and funding. The positive impacts of GIS include improved data accuracy and quality, transparency, and accountability in the development of Cooperatives and SMEs. The System Usability Scale (SUS) method provides a positive picture of user satisfaction, with an average score of 90 indicating the "acceptable" category and an "excellent" rating. This score reflects the effectiveness and ease of use of the system. Overall, this geographic information system has succeeded in supporting the efficient data collection of Cooperatives and SMEs.

Keywords: *Geographic Information (GIS), Data Collection, Cooperatives, Small and Medium Enterprises (SMEs), East Sumba Regency.*

1. Introduction

Cooperatives and SMEs are two types of businesses that have an important role in the national economy. Cooperatives aim to advance the welfare of their members and the community, as well as build a national economic order. Meanwhile, SMEs are able to increase employment, provide economic services widely to the community, and play a role in income equality, encouraging regional economic growth, and realizing national economic stability.

These two types of businesses are regulated in different laws, namely Law of the Republic of Indonesia No. 25 of 1992 concerning Cooperatives and Law of the Republic of Indonesia No. 20 of 2008 concerning SMEs. However, cooperatives and SMEs have the same goal, namely to build the national economy. Therefore, these two types of businesses need to be fostered and developed in order to provide optimal benefits for the community and the state.

Geographic Information System is an information system that contains data with geographical and spatial references to an area. Data processing uses computer technology so that it is easy to combine into information as desired. GIS is understood as a system that functions to collect, organize, manage, store, and present various data related to the geographical conditions of a region. The Cooperatives and SMEs Office of East Sumba Regency as one of the Agencies directly related to Cooperatives and SMEs in this Regency. The Agency has collected data related to Cooperatives and SMEs in East Sumba Regency, but does not have visual data collection that can be seen related to the areas or locations of Cooperatives and SMEs. Therefore, research related to geographic information systems is carried out to map Cooperatives and SMEs that facilitate data collection.

2. Literature Review

2.1. Cooperation

Cooperatives come from the word "cooperation," which means working together for the common good. In general, cooperatives are understood as voluntary associations of people who come together to improve economic prosperity through democratically managed companies. Cooperatives consist of members with limited economic capabilities, cooperative and voluntary, where members are obliged

to develop and supervise businesses, as well as share risks and profits fairly. According to Law No. 17 of 2012, cooperatives are divided into Primary Cooperatives, which are established by individuals, and Secondary Cooperatives, which are established by cooperatives [1].

2.2. Small and medium Enterprises

According to Tambunan (2020) in Halim (2020) states that: Micro, Small and Medium Enterprises (SMEs) are independent productive business units, carried out by individuals or business entities in all economic sectors [2]**.** Furthermore, according to Supriyanto (2006) in his research, he concluded that SMEs are a solution to overcoming the level of poverty in Indonesia. The SME sector has great potential in absorbing labor, so that it can improve people's welfare [2].

2.3. Geographic Information System

A Geographic Information System (GIS) is a system that supports spatial decision-making and integrates location descriptions with the characteristics of phenomena in a location. GIS includes computer hardware and software for entering, storing, examining, integrating, manipulating, analyzing, and displaying data related to the position of the earth's surface. The goal is to manage and map spatial information and its attribute data with cartographic accuracy. GIS also functions for the acquisition, verification, storage, management, and analysis of geographic data [4].

2.4. Method Waterfall

The waterfall method is the most commonly used method in the development stage. The waterfall method is an SDLC approach that was first applied in software development. The waterfall model is often referred to as a sequential linear model or a classic cycle that starts from the initial planning stage to the maintenance stage at the end of system development. Each stage must be completed completely before proceeding to the next stage, and there is no possibility of going back or repeating to the previous stage [3].

2.5. Black Box

Black box testing is a testing method that focuses on observing execution results through test data and checking software functionality. The tester only observes the output produced without knowing or paying attention to the internal processes that occur. Like the black box analogy, the tester can only look at the exterior or interface of the system and check if the functions are working properly, without learning the internal details of the process. In other words, the tester only knows the Input and output, without understanding the internal mechanism that produces the output [4].

3. Research Methodology

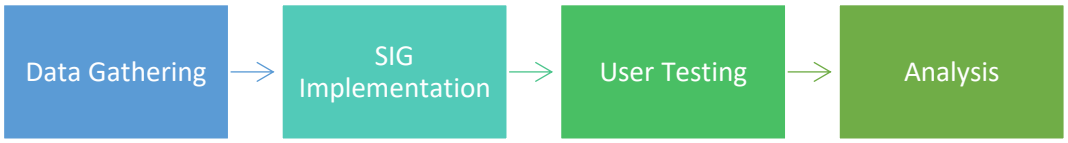


Figure 1: Research Flow

Information:

1. Logging
   The first is data collection, which is carried out to collect data from the Cooperative and SME Office through interviews, observations, and documentation.
2. GIS Creation
   After data collection, a Geographic Information System (GIS) was created with a waterfall software development method.
3. Testing to the User
   Once the software is generated, it will be tested for users, who will be given the opportunity to use the generated geographic information system and fill out questionnaires.
4. Analysis
   The results obtained will be analyzed to ascertain whether the resulting information system is suitable for use.

4. Results

4.1 System Planning

4.1.1. Use Case

In the image above, it describes the relationship between *the user* and the activities that occur in the system. In the system, there are two actors, namely admin and *user*. Admins will log *in* and admins can manage Cooperative and SME data, such as adding Cooperative data

and SMEs, displaying Cooperative and SME data, changing Cooperative and SME data, deleting Cooperative and SME data, *logging out,* while users can only see the Cooperative and SME location map display page.

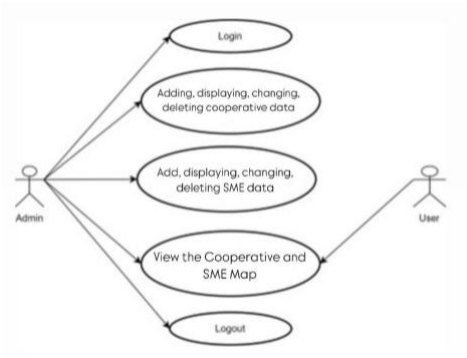


Figure 1: Use Case Diagram

4.1.2. Activity Diagram

4.1.2.1. Activity Login

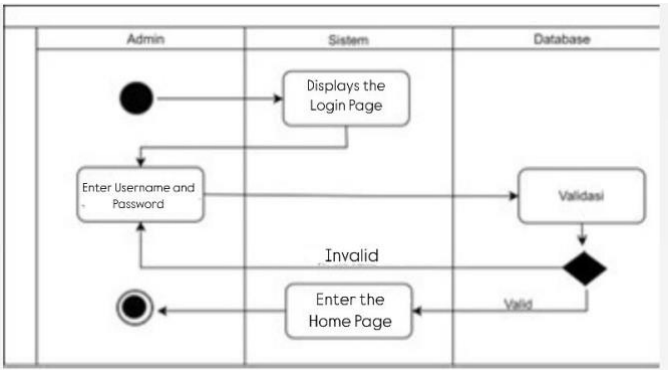


Figure 2: Activity Login

The image above explains the login process for admins to the main page. Admins can access the site through the login page by filling in the username and password fields. If the username and password entered are incorrect, then the admin needs to refill the username and password. However, if successful, the system will display the start page.

4.1.2.2. Add Data Activity

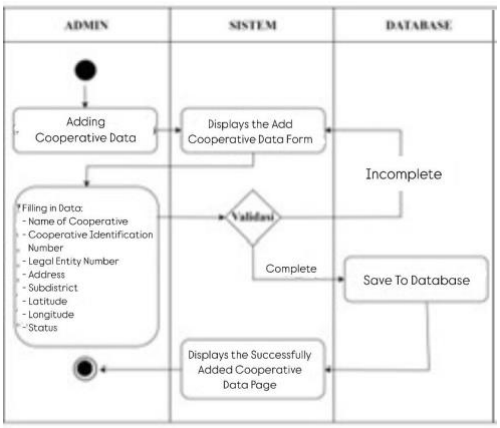


Figure 3: Activity Add Cooperative Data

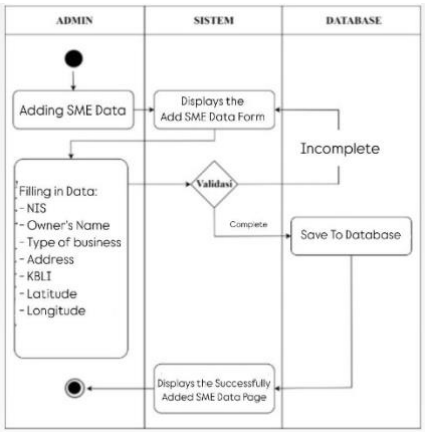


Figure 4: Activity Add SME Data

The image above explains the admin in the process of *entering* data on the location of Cooperatives & SMEs. After the admin logs in, the system will display the main menu where the admin will select the data input menu, then the system will display the data input page, then the admin will fill in the Cooperative & SME location data and then the system will save the data into the database.

4.1.2.3. Activity Edit Data

The image above explains the admin process in updating the Cooperative and SME location data, first the admin will select the data to be updated, then the data will be updated by the *database* and the Cooperative and SME data will be displayed on the admin.

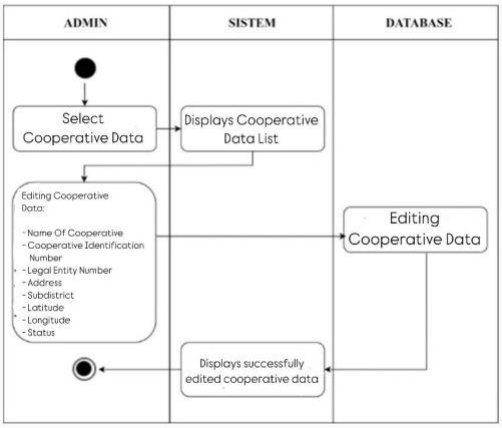


Figure 5. Activity Cooperative Data Edit

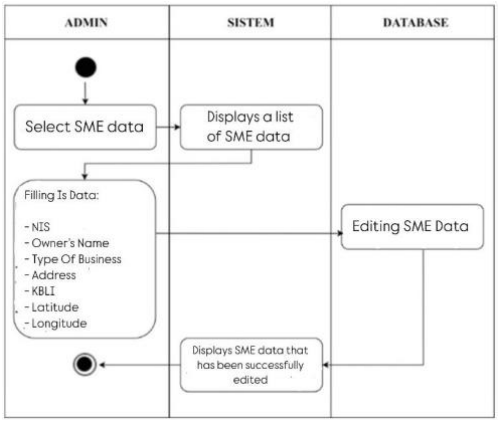
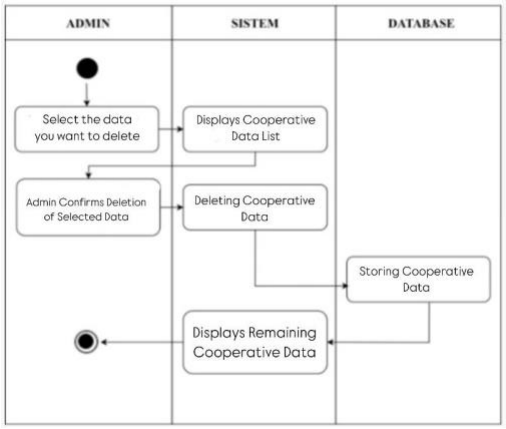


Figure 6. Activity Edit Data SME

4.1.2.4. Activity Delete Data

The figure below explains the admin process in deleting Cooperative and SME data. After the admin accesses the site, the system will display the Cooperative and SME data page. Next, admins can select the data they want to delete and must confirm the deletion of the data After confirmation, the system will delete the data, and the database will save the latest data. Then, the system will display the updated data. After this process, admins can log out.



. **Figure 7:** Activity Cooperative Data Delete

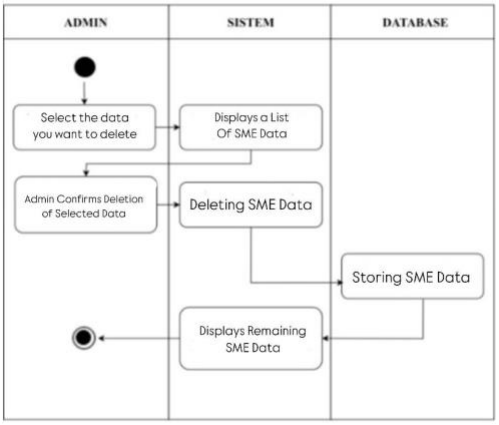


Figure 8: Activity of Delete SME Data

4.1.3. Class Diagram

The Class Diagram below explains the relationship between each class, namely the admin class with the Cooperative Data class, the SME Data class, and the Map class where the admin table is used for login and on the admin table there is a field id admin as the primary key, username and password are used as login validation to manage Cooperative Data. The SME Data List class contains important information about small and medium-sized businesses. The attributes contained in it include NIB, Company Name, Company Type, Location, and Business Type. Admins can perform operations such as adding, editing, and deleting SME data as needed. The Cooperative Data List class stores information related to cooperatives, with attributes such as NIK, Cooperative Name, Predicate, Address, and District. As in the SME class, admins can also add, edit, and delete cooperative data. The Map class describes geospatial information that Supporting cooperative and SMEs. Attributes in this class include Map Description and present related geospatial data. Available methods include displaying themap, editing map information, and deleting unnecessary map data.and SMEs. Attributes in this class include Map Description and

present related geospatial data. Available methods include displaying the map, editing map information, and deleting unnecessary map data.

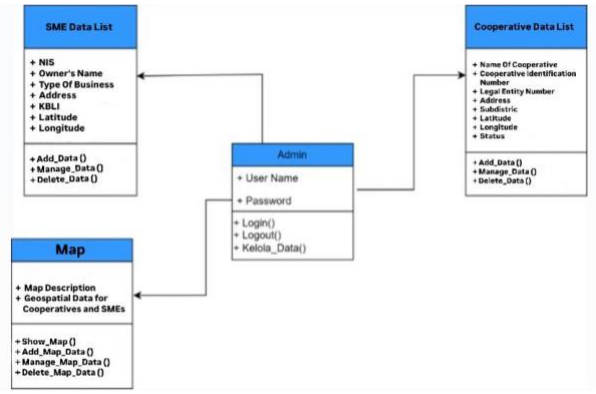


Figure 9. Class Diagram

4.2. System Implementation

4.2.1. Visitor Home Page

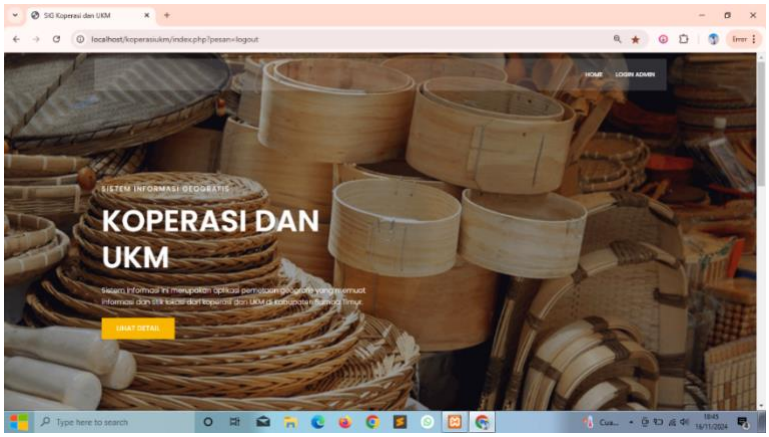


Figure 10: Visitor Home Page

The image above is a home page that contains the View Details menu and *home* that can be accessed by visitors to the View Details menu, serving to provide more information to users about the features or services available in the system. When this button is pressed, the user will usually be redirected to a Map page that explains details about the data related to Cooperatives and SMEs. And there is a LOGIN Button admin is created for admin to log in to the system, by clicking on this button, Admin will be redirected to the login page where they are asked to enter credentials such as username and password.

4.2.2. Cooperative and SME Distribution Map Page

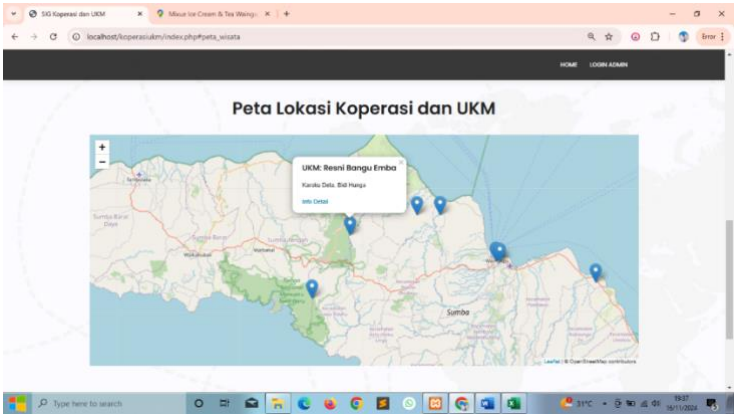


Figure 11: Distribution Map and Cooperative Page

The image above is a menu page of the distribution map of Cooperatives and SMEs in East Sumba Regency that can be seen by Admins and Users, where the map can display location points based on the data filled in by the admin and there is detailed info from the location.

4.2.3. Detailed Information Page

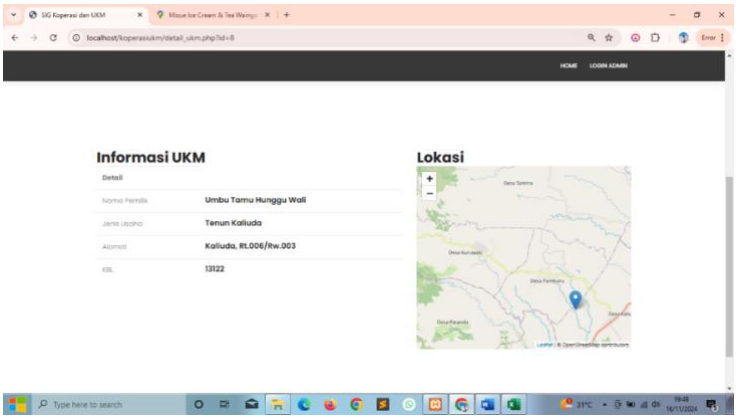


Figure 12: Detailed Information Page

The image above is a page of detailed information about the location data of Cooperatives and SMEs, which can be seen by users. The information is in accordance with the data filled in by the *Admin*. Such as information related to Owner Name to Display the name of the business owner. Business Type, to indicate the category or type of business that is run. Location to Provide information about the business location, which may include the address or description of the Location, and the NIB**,** to Be the Business Identification Number that becomes the official identity of the business.

4.2.4. Login Page

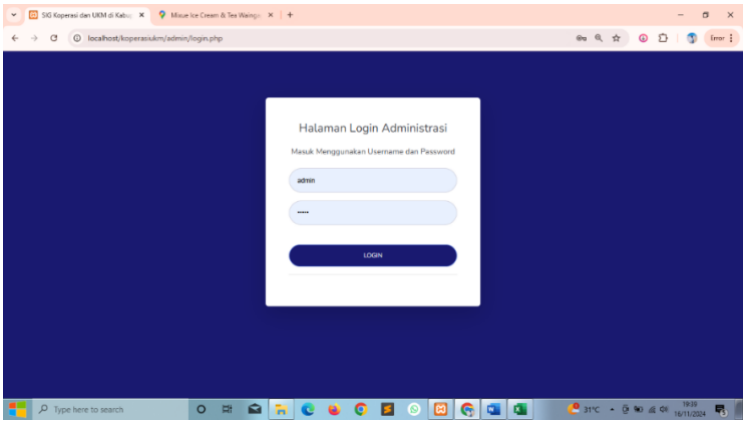
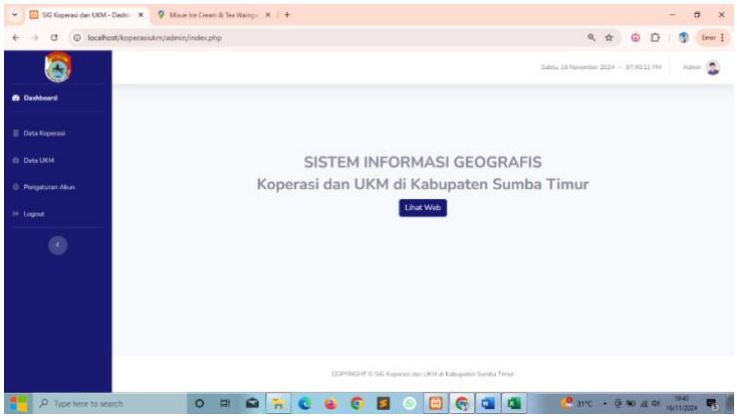


Figure 13: Login Page

The image below is a login, page that contains a username field to enter the username according to the registered username and Password to enter the password associated with user. This page serves as a login for admins to enter the system. Only users with valid credentials can proceed to more sensitive data and information management features. The existence of this login page is important to maintain the security and privacy of data in the system

4.2.5. Dashboard Page



Gambar 14: Halaman Dashboard

The image above is the *Dashboard* page, which when "*clicked" by the admin*, a map of the distribution of Cooperatives and SME locations in East Sumba Regency will appear.

4.2.6. Cooperative Data Page

The image below is the Cooperative Data page, this page serves to provide a concise overview of all Cooperative data filled in the system. Admins can easily view, search, or manage cooperative data. Column in the Cooperative Name table displays the name of each cooperative. Cooperative registration number, as a unique identity for each cooperative. Legal Entity Number, shows the legality of the cooperative. Address Shows where the cooperative is located. Latitude and Longitude, for geographic coordinates that indicate the exact location of an undertaking, are useful for maps and navigation. Add Data button, to add new data to the system, such as filling in new cooperative data. Edit Data button, to change the cooperative data you want to change, Delete Data button, to delete the cooperative data you want to delete. And there is a search button, to search for cooperative data.

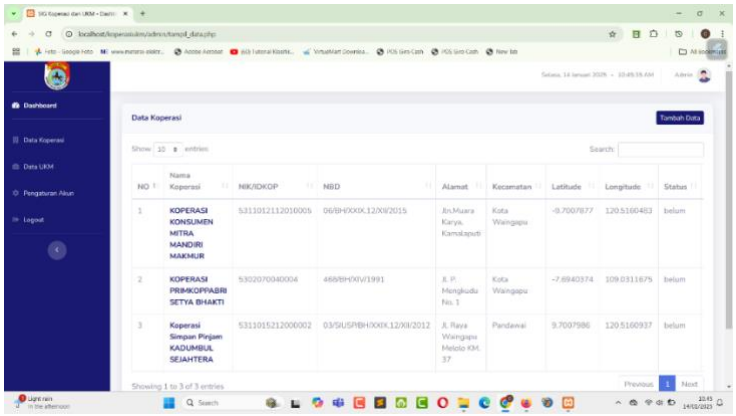


Figure 15: Cooperativ Data Page

4.2.7. SME Data Page

The image below is the SME Data page, this page serves to provide a concise view of all SME data filled in the system. Admins can easily view, search, or manage SME data. The columns in the table, Owner Name to display the name of the business owner of each SME. Type of Business, Indicates the category or type of business that is run by the UKM. Address, to provide the address of the location of the business, which aids in identification and searching. NIB, for Business Identification Number, which is the official identity for SMEs. Latitude and Longitude, for geographic coordinates that indicate the exact location of the effort, are useful for maps and navigation. Add Data button, to add new data into the system, such as filling in new SME data. Edit Data button, to change the SME data you want to change, Delete Data button, to delete the SME data, which you want to delete. And there is a search button, to search for SME data**.** Data button, to add new data into the system, such as filling in new SME data. Edit Data button, to change the SME data you want to change, Delete Data button, to delete the SME data, which you want to delete. And there is a search button, to search for SME data.

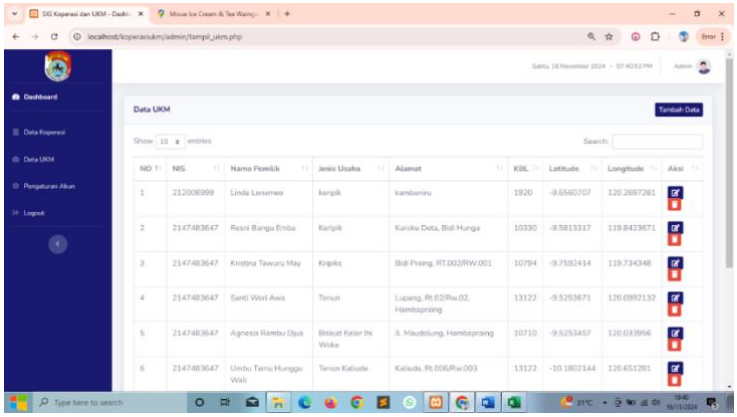


Figure 16: SME Data Page

4.2.8. Account Settings Page

The image above is an account settings page, only Admins have access to make changes to the username and password of the account in the system. This is important to maintain data security and integrity.

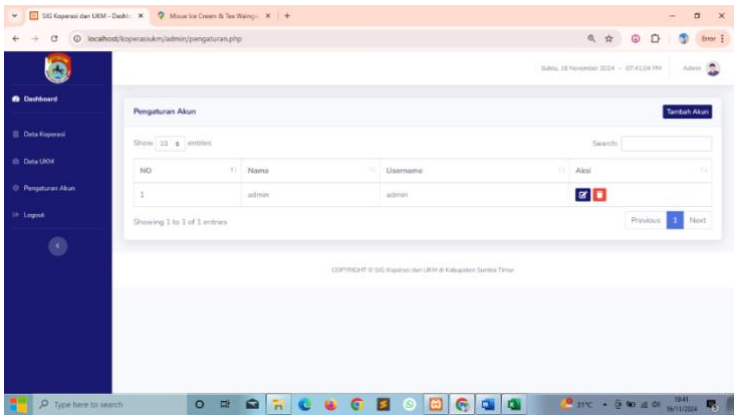


Figure 17: Account Settings Page

4.3. Black box testing

4.3.1. Black Box Admin Testing

Table 1: Black Box Testing

No	System Under Test	Test Method	Expected Results	Description
1	Login Admin	*Username* dan *Password* Benar	Sistem menerima akses *Login* kemudian akan menampilkan halaman beranda admin	Berhasil[√]
		Username dan *Password* Salah	Sistem menolak akses *Login* kemudian akan menampilkan *Alert "Username and Password Is Not Valid"*	Berhasil[√]
	Menu *Dashboard*	Klik menu Lihat Web	Sistem akan menampilkan Peta sebaran Koperasi dan UKM di Kabupaten Sumba Timur	Berhasil[√]
	Menu Data Koperasi	Klik Menu Data Koperasi	Akan muncul tabel data koperasi	Berhasil[√]
		Klik Ikon Tambah Data	Akan tampil *form* tambah data Koperasi	Berhasil[√]
		Klik Ikon Edit Data	Akan tampil *form* edit data Koperasi	Berhasil[√]
		Klik Ikon Hapus Data	Akan muncul konfirmasi hapus data dan data Koperasi di hapus	Berhasil[√]
	Menu Data UKM	Klik Menu Data Koperasi	Akan muncul tabel data	Berhasil[√]
		Klik Ikon Tambah Data	Akan tampil *form* tambah data	Berhasil[√]
		Klik Ikon Edit Data	Akan tampil *form* edit data	Berhasil[√]
		Klik Ikon Hapus Data	Akan muncul konfirmasi hapus data dan data di hapus	Berhasil[√]
	Menu Pengaturan	Admin dapat mengubah *Username* dan *Password*	Menampilkan *Username* dan *Password* yang baru	Berhasil[√]
	Logout	Klik tombol *logout*	Akan kembali ke halaman beranda	Berhasil[√]
	Search	Menulis Kriteria Pencarian	Akan muncuk tampilan sesuai pencarian	Berhasil[√]

4.3.2. Black Box Visitor Testing

Table 2: User Black Box Testing

No	System Under Test	Test Method	Expected Results	Description
1.	Menu Beranda	Klik Lihat Detail	Sistem akan menampilkan Peta sebaran Koperasi dan UKM di Kabupaten Sumba Timur	Berhasil[√]
2.	Menu Peta Sebaran Koperasi dan UKM	Zoom Peta	Peta akan tampil besar	Berhasil[√]
		Klik Info Detail	Akan muncul data Koperasi dan UKM yang sudah di *inputkan*	Berhasil[√]

4.4. System Usability Scale (SUS)

In the test of the Geographic Information System for Cooperative and SME Data Collection using *the System Usability Scale* (SUS) method, the test was carried out to 10 respondents consisting of Cooperative Data Admin, SME Data Admin, 3 Employees at the East Sumba Cooperative and SME Office and five East Sumba Communities. The score results obtained from respondents in the application test using *the System Usability Scale* (SUS) can be seen in the Table 3.

Table 3: Score Results from Respondents

Respondents	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
1	5	5	5	5	5	1	5	2	5	3
2	4	4	4	4	4	2	4	2	4	4

3	4	4	4	4	4	2	4	2	4	4
4	4	4	4	3	4	2	4	2	4	4
5	5	5	5	1	5	1	5	1	5	5
6	5	5	5	1	5	1	5	1	5	5
7	3	3	3	3	3	3	3	3	3	3
8	5	5	5	3	4	2	4	2	4	3
9	5	3	5	1	5	2	5	1	3	5
10	4	5	5	3	4	3	5	2	5	3

Table 4 displays the results of the test conducted by 10 (ten) respondents by filling out a questionnaire that has 10 (ten) statements. *The System Usability Scale* (SUS) test data will be analyzed using calculations in accordance with the calculation rules of the *System Usability Scale* (SUS) method.

Table 4.:SUS GIS Score Analysis Data Collection

Respondents	Statement SUS										Total	Score SUS
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
1	4	4	5	5	5	1	4	2	4	3	37	92,5
2	4	4	4	4	4	2	4	2	4	4	36	90
3	4	3	3	4	5	2	3	2	4	4	34	85
4	4	4	4	3	4	2	4	2	4	4	35	87,5
5	5	5	5	1	5	1	5	1	5	5	38	95
6	5	5	5	1	5	1	5	1	5	5	38	95
7	3	3	3	3	3	3	3	3	3	3	30	80
8	5	4	4	3	4	2	4	3	4	3	36	90
9	5	3	5	1	5	2	5	1	3	5	35	87,5
10	4	5	5	3	4	3	5	2	5	3	39	97,5
Total												900

The number of respondents' SUS scores in this study is 900 as shown in Table 4. This is what was obtained from 10 respondents. For the next calculation, the SUS score of each respondent was sought for the average score. The formula for calculating the average SUS score can be seen in the Mathematical Formula.

$$x = \frac{900}{10} = 90$$

The results of the calculation show that the average SUS score is 90. Based on the results of the average score obtained, the feasibility of the Geographic Information System is then determined by looking at *the grade* in accordance with the rules applicable to the SUS method, as shown in Figure 18.

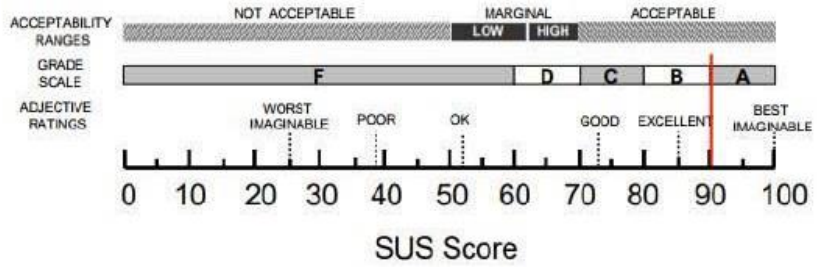


Figure 18: Score SUS

Determination of *Acceptability Ranges, Grade Scale,* and *Adjective Rating* in determining user satisfaction of the Geographic Information System for Cooperative and SME Data Collection, the average result of the respondent's score is 90, therefore the results of the assessment of the Geographic Information System for Cooperative and SME Data Collection are included in the Acceptable category. The *grade scale* level is in the B category and *the adjective rating is in* the Excellent category. The score obtained is a score that is above the average score, which means that the score is included in a fairly good rating that is almost very good.

5. Conclusion

The implementation of geographic information systems for data collection of Cooperatives and SMEs in East Sumba Regency shows significant ease in data management. The home page is made intuitive, providing easy access to important features, including a distribution map page that displays the locations of Cooperatives and SMEs. Detailed information about the business is presented clearly, including the owner's name, type of business, address, and business identification number. The login page guarantees system security, allowing only access for admins with valid credentials. The black box tests conducted showed that all functionalities worked as expected, both for admins and visitors, with satisfactory test results. The System Usability Scale (SUS) method provides a positive picture of user satisfaction, with an average score of 90 indicating the "acceptable" category and an "excellent" rating. This score reflects the effectiveness and ease of use

of the system. Overall, this geographic information system has succeeded in supporting the efficient data collection of Cooperatives and SMEs.

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