Determination of the Shortest Path in Web-Based Food Distribution

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Determination of the Shortest Path in Web-Based Food Distribution

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Abstract: Food insecurity can be seen in terms of production, consumption, and distribution. The aspect of food insecurity is the ability to produce unbalanced with the fulfillment of needs. Production capability is not seen from the availability side, because availability can be met from the inter-regional supply. The consumption aspect is the inability to buy food because there is no purchasing power or the poor. The availability of food that does not meet the needs of the community resulting in food insecurity. Then the way to handle food insecurity in the region of Bondowoso is by distributing food that requires the shortest path to overcome the many areas that must be assisted given. Determination of the shortest path is a problem to find a path between two nodes with a minimum number of weights. The shortest path can be applied in the form of web-based application programs.

Keyword : Food insecurity, *Web-based food distribution,* Dijkstra

1. INTRODUCTION

1.1 Background

Food problems are a major problem for citizens of countries around the world, including Indonesia. In 1984 Indonesia had experienced a glorious period in the field of food, namely achieving self-sufficiency in food (rice). This food insecurity can occur due to sudden and unexpected shocks such as droughts and explosive pests, which severely limit household ownership of food, especially those in rural areas. Food insecurity can be seen in terms of production, consumption, and distribution. The aspect of food insecurity is the ability to produce unbalanced with the fulfillment of needs. Production capability is not seen from the availability side, because availability can be met from the inter-regional supply. The consumption aspect is the inability to buy food because there is no purchasing power or the poor. The aspect of distribution is the imbalance of supply to meet demand so that food scarcity occurs at a certain place, time, quantity, and price. (Mapping of Food-Prone Areas in Bondowoso Regency in collaboration with the State Polytechnic of Jember with the Bondowoso Regency Food Security Office, 2013).

The availability of food does not meet the needs of the community resulting in food insecurity. Then the way to handle food insecurity in the Bondowoso area is by distributing food that requires the shortest path to overcome the many areas that must be assisted. Determination of the shortest path is a problem to find a path between two nodes with a minimum number of weights. The shortest path can be applied in the form of web-based application programs.

2. REFERENCES

2.1 Determination of the Shortest Path

Determination of the shortest path is done to find a path and facilitate access to the distribution of goods between two nodes with a minimum amount of weight. In the case of determining the shortest path between two different locations on a map, the node will represent the location on the map and the weight represents the time needed to travel between the two locations. Determination of the shortest path can only be used on the main road or arterial road so that public transportation can cross the shortest path.

The user enters the origin and destination data on the system and then searches for the shortest path starts from filling the point (node) with the lowest weight, so the output is information on the name of the shortest sub-district along with the total distance traveled.

2.2 Definition of Distribution

Distribution is a marketing activity that seeks to facilitate the delivery of goods and services from producers to consumers so that their use is following what is needed (type, quantity, price, place, and when needed). [1]

2.3 Definition of food

This food is a basic need for humans, its role which is very influential in daily life is progressing rapidly because of the increasing population density from year to year. The food needed is rice, tubers, fruits, eggs, meat, beans, etc. Food that is a basic need must fulfill 4 (four) healthy 5 (five) perfect. 4 (four) healthy foods 5 (five) are perfect foods that contain carbohydrates, protein, vitamins that must be considered every day such as rice, vegetables, meat or fish, fruits, and can be added to milk. Try to process vegetables not too long how to cook it so that the vitamin levels are not lost. [2]

2.4 Bondowoso

Bondowoso is the only district in the horseshoe area that does not have a coastline. Bondowoso Regency is one of the districts in the province of East Java. Bondowoso Regency has an area of 1,560.10 km^2 which is geographically located at coordinates between 113 ° 48′10 ″ - 113 ° 48′26 ″ East and 7 ° 50′10 ″ - 7 ° 56′41 ″ LS. Bondowoso Regency has a fairly cool temperature range of 15.40 ^{0}C - 25.10 ^{0}C because it is located in the mountains. Bondowoso Regency is not crossed by a state road that connects between provinces and Bondowoso also does not have seas, which makes Bondowoso difficult to develop compared to other districts in East Java. The majority of the inhabitants who inhabit the area of Bondowoso Regency are from Javanese and Madurese tribes with a livelihood as farmers. The natural condition of Bondowoso also provides great potential as a contributor to the visit in East Java tourism, because here there are several attractions worth visiting such as Ijen Crater, Jampit Plantation, Polo Agung Waterfall, and others. [3]

4 RESULTS AND DISCUSSION

4.1 Requirement analysis dan definition

At this stage, the user tells the needs of the program to be made. This application requires complete and appropriate information that is the name of the district, the shortest path and the total distance traveled. To build this application requires real data that is matched with the information needs in the following.

Table 1. Data *Kecamatan*

No	Kecamatan
1	Bondowoso
2	Tegalampel
3	Tenggarang
4	Taman Krocok
5	Wonosari
6	Tapen
7	Klabang
8	Botolinggo
9	Prajekan
10	Cermee
11	Sukosari
12	Sumber wringin
13	Sempol
14	Tlogosari
15	Pujer
16	Jambesari Darus Sholah
17	Tamanan
18	Maesan
19	Grujugan
20	Curahdami
21	Binakal
22	Pakem
23	Wringin

Data from these sub-districts is used as a table to help determine the shortest path, while graphical visualization media in the form of graphs requires village data consisting of village code or Kode, sub-district name or Kecamatan, village name or Desa, and postal code or Kode Pos. Can be seen as follows.

Kode	Kecamatan	Desa	Kode pos
0101	Binakal	Baratan	68251
0102	Binakal	Bendelan	68251
0103	Binakal	Binakal	68251
0104	Binakal	Gadingsari	68251
0105	Binakal	Jeruk Soksok	68251
0106	Binakal	Kembangan	68251
0107	Binakal	Sumbertengah	68251
0108	Binakal	Sumberwaru	68251
0201	Bondowoso	Dabasah	68211
0202	Bondowoso	Blindungan	68212

Figure 1 Data of Villages

In determining the shortest path, a distance table is also needed to see the weight value, which is the number of distances, and the sub-district table is used to determine the potential of food in the area by looking at the amount of yield.

Kode	Kec. asal	Kec. tujuan	Jarak	Nama Jalan
1	bondowoso	tenggarang	2870	Jl. PB. Sudirman
2	bondowoso	tegalampel	1680	Jl. RA. Kartini
3	bondowoso	wringin	12110	Jl. Diponegoro, Jl. Raya Wringin,
4	bondowoso	binakal	5740	N/A
5	bondowoso	curahdami	3430	Jl. Letnan Rantam
6	bondowoso	grujugan	7840	Jl. Ahmad Yani, Jl. Bondowoso-Jember, Jl. Mastrip
7	bondowoso	tamanan	11970	N/A
8	tegalampel	bondowoso	1680	Jl. RA. Kartini
9	tegalampel	wringin	11480	N/A
10	tegalampel	tenggarang	2800	N/A
11	tegalampel	taman krocok	6720	Jl. KH. Ali

Figure 2 Distance data between origin and destination

Kode	Kecamatan	Alamat	Padi	Jagung	Ubi Kayu
1	Binakal	Jl. Binakal	4.022	2.926	0
2	Bondowoso	Jl. Letjen Haryono MT. No 32	8.596	1.147	0
3	Botolinggo	N/A	4.969	8.670	0
4	Cerme	Jl. Raya Cerme	9.443	17.122	0
5	Curahdami	Jl. Poncogati Curahdami	6.994	6.404	0
6	Grujugan	Jl. Jember Grujugan	7.927	4.438	0

Figure 3 Data on the potential for food crops in each district

This application was created based on user needs regarding the information on the potential of foodstuffs in each region in Bondowoso. Information on food potential will be used as graphical visualization media in the form of graphics so that the public and the Office of Food Security can easily predict areas that are experiencing food insecurity. After knowing the area is experiencing food insecurity, the user wants an application that can be used to handle the process of distributing food so that it is faster and more efficient because of the large number of areas that must be provided with assistance. This application provides a solution in the form of determining the shortest path to get to the place that was first given assistance by seeing the path closest to its headquarters.

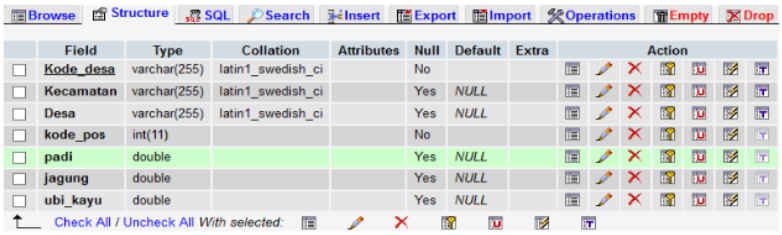
4.2 Implementation and unit testing

This stage is the core stage of all analyzes that have been carried out at an early stage. This stage is the stage of making the program. Database design and design is done using the PHP programming language with Dreamweaver CS5 tools, after which a trial program is run when filling, updating, and deleting data in tables (forms). The following are the stages of system implementation:

1. Creating *Database*

The database functions to accommodate the tables that have been created in the class diagram design. Making a table includes the process of naming fields and selecting

detailed data types and determining the index (primary key) to create relations between tables. Can be seen in the following image.



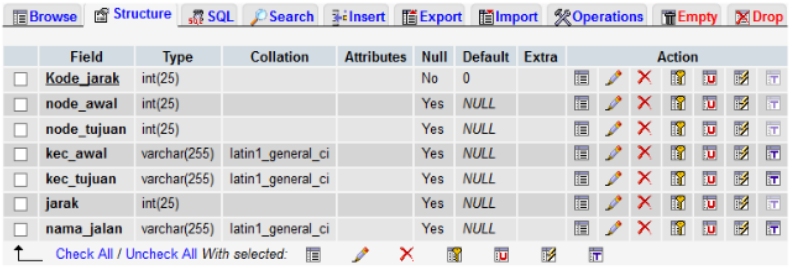
Browse | Structure | SQL | Search | Insert | Export | Import | Operations | Empty | Drop

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	Kode_desa	varchar(255)	latin1_swedish_ci		No			
☐	Kecamatan	varchar(255)	latin1_swedish_ci		Yes	NULL		
☐	Desa	varchar(255)	latin1_swedish_ci		Yes	NULL		
☐	kode_pos	int(11)			No			
☐	padi	double			Yes	NULL		
☐	jagung	double			Yes	NULL		
☐	ubi_kayu	double			Yes	NULL		

Check All / Uncheck All With selected:

Figure 4 The data structure in the Village Table uses a MySQL database

In the village data database, there are 7 (seven) fields, namely kode_desa that is also selected as primary key kecamatan, desa, kode_pos, padi, jagung, dan ubi_kayu.



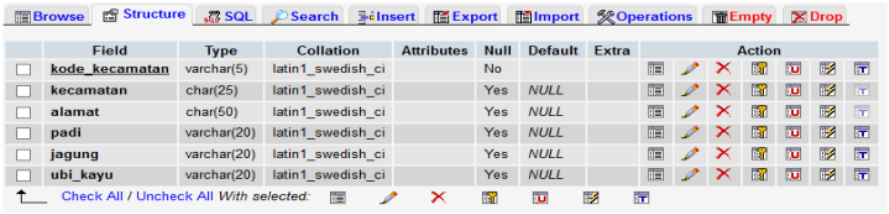
Browse | Structure | SQL | Search | Insert | Export | Import | Operations | Empty | Drop

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	Kode_jarak	int(25)			No	0		
☐	node_awal	int(25)			Yes	NULL		
☐	node_tujuan	int(25)			Yes	NULL		
☐	kec_awal	varchar(255)	latin1_general_ci		Yes	NULL		
☐	kec_tujuan	varchar(255)	latin1_general_ci		Yes	NULL		
☐	jarak	int(25)			Yes	NULL		
☐	nama_jalan	varchar(255)	latin1_general_ci		Yes	NULL		

Check All / Uncheck All With selected:

Figure 5 The data structure in the Distance Table uses a MySQL database

In the distance data database there are 7 (seven) fields, namely the kode_jarak which is also selected as the primary key, node_awal, node_tujuan, kecamatan_awal, kecamatan_tujuan, jarak, and nama_jalan.



Browse | Structure | SQL | Search | Insert | Export | Import | Operations | Empty | Drop

	Field	Type	Collation	Attributes	Null	Default	Extra	Action
☐	kode_kecamatan	varchar(5)	latin1_swedish_ci		No			
☐	kecamatan	char(25)	latin1_swedish_ci		Yes	NULL		
☐	alamat	char(50)	latin1_swedish_ci		Yes	NULL		
☐	padi	varchar(20)	latin1_swedish_ci		Yes	NULL		
☐	jagung	varchar(20)	latin1_swedish_ci		Yes	NULL		
☐	ubi_kayu	varchar(20)	latin1_swedish_ci		Yes	NULL		

Check All / Uncheck All With selected:

Figure 6 The data structure in the District Table uses a MySQL database

In the kecamatan data database there are 6 (six) fields, namely the kode_kecamatan which is also selected as the primary key, kecamatan, alamat, padi, jagung, ubi_kayu.

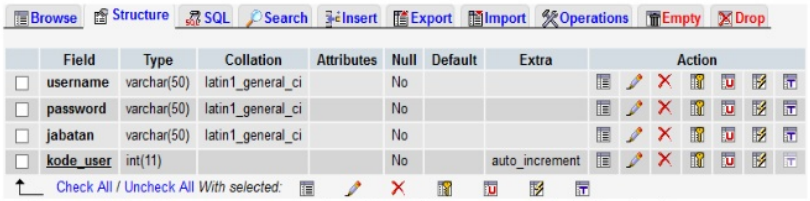


Figure 7 The data structure in the User Table uses a MySQL database

In the user data database there are 4 (four) fields, i.e. Kode_user which is also selected as the primary key, username, password, and jabatan.

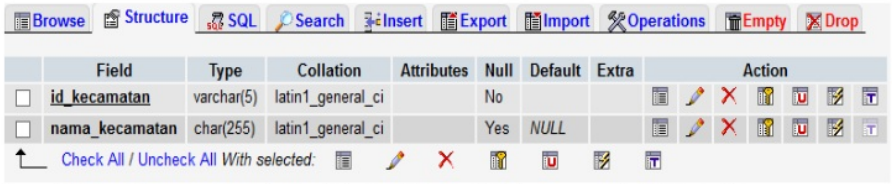


Figure 8 The data structure in the District Master Table uses a MySQL database

In the sub-district data database, there are 2 (two) fields, namely nama_kecamatan and id_kecamatan which are also selected as the primary key.

2. Making the Main Menu Display

a. Main Menu *User*

Figure 9 User Main Menu / Login Form

This picture explains the main view for the user. There are 4 (four) menus, namely main content, graphics, shortest path, and calendar. The main content menu is the home and search menus. The home menu functions to return to the initial display. The search menu has a combo box that can search by sub-district name and yield, while the graph menu

only has a menu of food potential, which can only display graphs. The shortest path menu has a path result menu which only fills in the combo box with various sub-district name options after that press the search button, and information about the shortest path will appear.

b. Admin Main Menu

Figure 10 Admin Main Menu

This picture explains the main view for admins in determining the shortest path. There are 5 menus namely main content, graphics, shortest path, user management, and calendar. The main content menu is the home and search menus. The home menu functions to return to the initial display. In the search menu, there is a combo box that can search by sub-district name and yield, while the graph menu only has a menu of food potential, which can only display graphs. The shortest path menu has a path result menu which only fills in the combo box with various sub-district name options after that press the search button and then information about the shortest path will appear. In the admin, menu display there is an additional menu because the admin has the duty to add and determine the user's position. This user management menu has 3 submenus, i.e. user list, added users and user updates.

c. Main Menu Head of Department of Food Security

Figure 11 Main Menu Head of Department of Food Security

This picture explains the main display for the Head of the Department of Food Security. There are 7 menus, namely main content, graphics, shortest path, village data, sub-district data, distance data, and calendar. The main content menu is the home and search menus. The home menu functions to return to the initial display. The search menu has a combo box that can search by sub-district name and yield, while the graph menu only has a menu of food potential, which can only display graphs. The shortest path menu has a path result menu that only fills in the combo box with various sub-district name options after that press the search button, and finally, information about the shortest path will appear. The menu display of a Head of the Department of Food Security has an additional menu because it has an important role which is to complete the database. The village data menu, sub-district data, distance data, user data have 3 submenus, namely adding data, updating data and listing data.

Data completeness is only carried out by a Head of the Department of Food Security, including village forms, sub-district forms, distance forms, and user forms. The following image can be seen below:

Figure 12 Village Form

In this village form image there are columns that must be filled in as data completeness. There are 7 fields including them kode_desa, kecamatan, desa, kode_pos, padi, jagung, dan ubi_kayu.

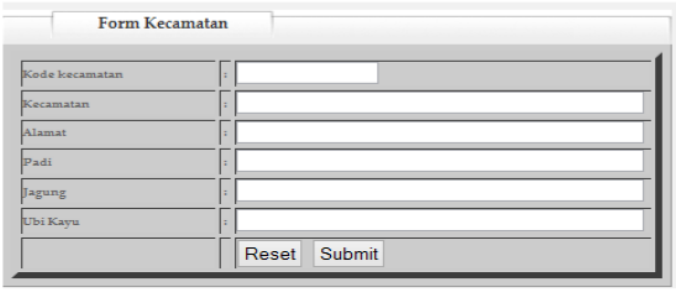


Figure 13 District Form

In this figure, there are columns which must be filled in as data completeness. There are 6 fields including them kode_kecamatan, kecamatan, alamat, padi, jagung, and ubi_kayu.

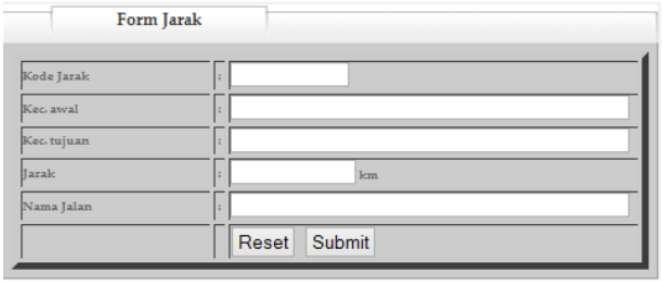


Figure 14 Distance Form

In this figure, there are columns that must be filled in as data completeness. There are 5 fields including them kode_jarak, kecamatan awal, kecamatan tujuan, jarak, nama_jalan and ubi_kayu.

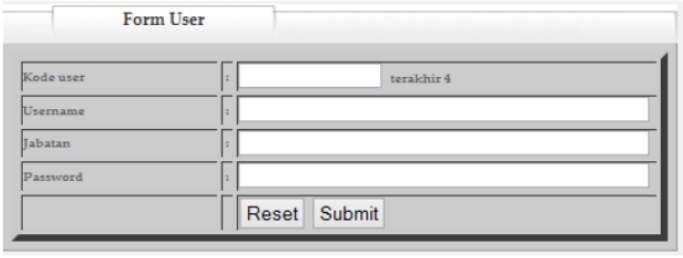


Figure 15 User Registration Form

In this user form figure there are columns that must be filled in as data completeness. There are 4 fields including them kode_*user*, *username*, jabatan, dan *password*.

4.3 Integration and system testing

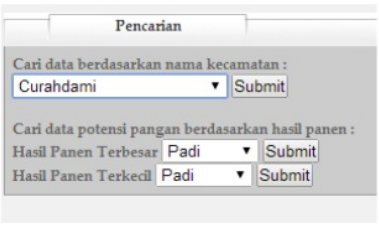
This stage is the testing phase of an application in the shortest path determination application. Application testing is said to be successful if the web display has been linked according to page one with another page and can appear alternately according to the

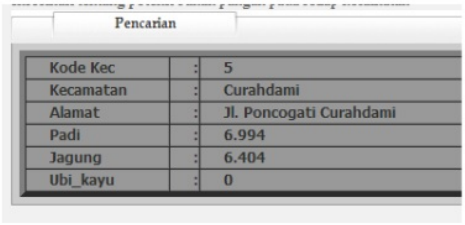
selected choice. Web appearance goes according to the expectations of the author. Form (table) added data also functions to store data entered into detailed data. Following is an example of testing an application on the main menu display of an Admin and its access rights.

An Admin runs an application to determine the shortest path, first, the Admin does the login and then displays the main menu in accordance with the permissions that are adding a new user and can determine the user's position. More can be seen in the following picture:

Figure 17 Admin Main Menu

We choose the main content menu, in which there are 2 (two) submenu choices, namely the home menu and search. In the search menu, we can search for data by sub-district name and also food potential based on yield.





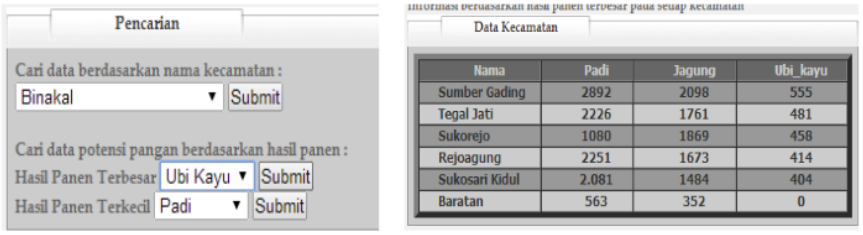


Figure 18 Search results based on district names and yields

The following figure 4.18 shows graphical visualization media in the form of graphs to find out the amount of potential foodstuff in the Bondowoso area.

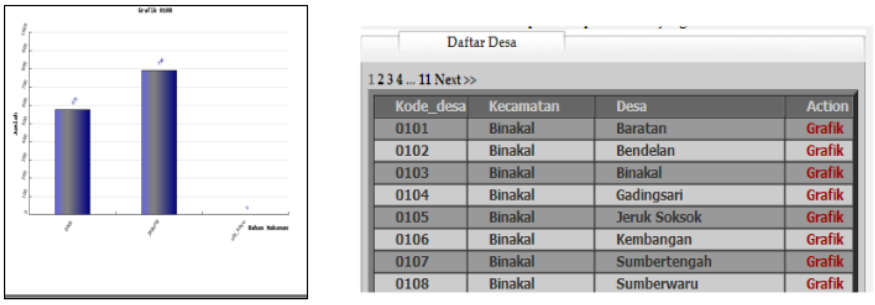


Figure 19 Graphic Visualization media

After the user sees the graphical visualization media in the form of graphics. Users can see the shortest path determination application by filling in the combo box so the search button can function to find the shortest path.

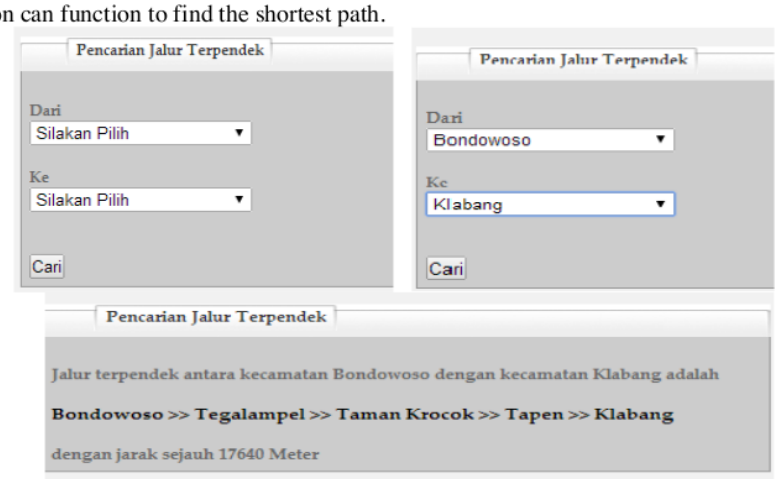


Figure 20 Shortest Path Application

Users can also add new users, so users registered in the user list table can log in according to their access rights. Next to appear the form added a new user, after filling in the form

the data will automatically be saved in the list menu. Admin can change the position from an admin to a head of a service in the update menu by selecting edit in the action column.

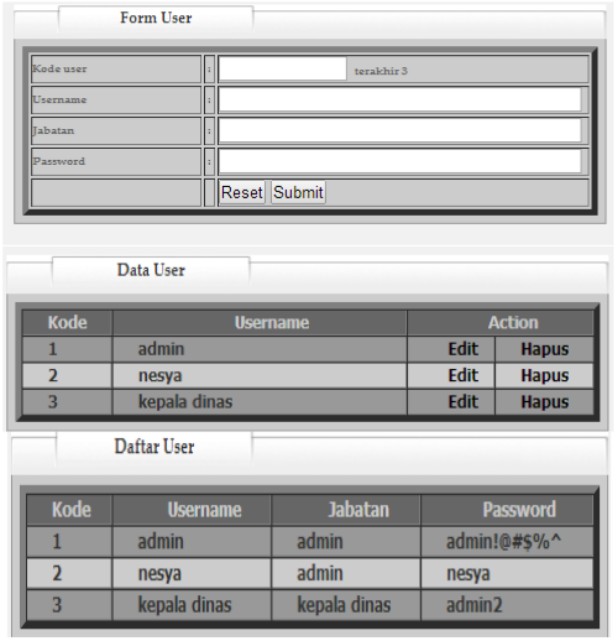


Figure 21 Management Users Menu

4.4 Operation and maintenance

This stage is to operate the application environment and carry out maintenance. Maintenance here is to make adjustments in each change because the application must adapt to the actual situation, where the data - the needs of this application can still be updated or added.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The conclusions that can be drawn from making the Shortest Path Determination Application are:

1. Determination of the shortest path can be applied to web pages.
2. This application will help the community in finding the shortest path so that they can work together with the Head of the Department of Food Security to assist the distribution of food at several points or places that have been determined so that access to the distribution of goods or activities to supply food to the community is also quickly handled and not reached delayed until protracted.
3. Graphical visualization media as additional information about the potential of foodstuffs contained in the Bondowoso area through graphical visualization in the form of graphics, the public can find out food items that are increasing and areas that are experiencing food insecurity so that assistance will soon come to the area.

5.2 Recommendations

Suggestions that can be put forward to help the perfection of the Shortest Path Determination Application: For further research applications need to be made that can perfect the shortest path determination application. This application program does not use any method in determining the shortest path, therefore it is recommended to use a method including the Dijkstra algorithm. [4]

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