

Mobile Application of Water Meter Recorder Based on Short Message Service Transmissions Using Windows Mobile Platform

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Abstract

The rapid development of technology nowadays has major impact to the development of cellular technology. This development led to a new wide range of smartphone. The growth of life nowadays requires people to work more quickly, so that they can use the time more effective and increase the performance. The process which done manually takes a lot more time than the process which done automatically, because the process which done manually have a higher risk of error than the process which done automatically. The process that are still done manually is recording the amount of customer water consumption in PDAM (Regional Water Company). This problem can be solved by creating mobile application that can record the water meter and then automatically send the data of the customer and the amount of water use directly to the computer server and calculated automatically. This application can solve the problem in recording the water meter.

Keywords: *Mobile Phone, Water Meter, SMS.*

1. Introduction

The rapid development of technology nowadays has a major impact in the development of mobile technology, one of them was the birth of mobile phone. Mobile phone is an electronic telecommunication device that has the same basic capabilities of conventional fixed-line telephone, but it can be carried anywhere (portable) and no need to be connected to the telephone network by wire (wireless). The development of mobile phones led to a wide range of smartphone. The smartphone is a mobile phone that has a high level of ability with computer-like functions. The rapid development of the smartphone gave birth to the new various of operating system.

Operating system (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is a vital component of the system software in a computer system. Application programs require an operating system to function. [8] Mobile operating system, also referred to as mobile OS, is the operating system that operates a smartphone, tablet, PDA, or other digital mobile devices. Modern mobile operating systems combine the features of a personal computer operating system with touchscreen, cellular, Bluetooth, WiFi, GPS mobile navigation, camera, video camera, speech recognition, voice recorder, music player, Near field communication, personal digital assistant (PDA), and other features. [9]

New technology that comes along the development of mobile technology is an SMS Gateway. SMS gateway is a telecommunications network facility for sending or receiving Short Message Service (SMS) transmissions to or from a telecommunications network that supports SMS. Most messages are eventually routed into the mobile phone networks. [1]

The development of modern life requires everyone to work more quickly so the time can be used efficiently, so the performance should be improved. Enhancement performance should be accompanied by work faster and more accurately so that the work can be done with a single process. The process which done manually takes a lot more time than the process which done automatically, because the process which done manually have a higher risk of error than the process which done automatically.

One of the process that are still done manually is recording the amount of customer water consumption in PDAM (Regional Water Company). PDAM is one of regional business unit that engaged in the distribution of clean water to the public. PDAM available in each province and districts throughout Indonesia. The process of recording the water meter are still done manually by writing every water meter in each customer house and then recapitulated manually.

The problems that arise from the process of recording the water meter is the officer still recorded on paper and then manually recapitulated in the computer. This process takes a lot of time and have a high risk of errors that officer repeatedly checks to reduce the risk of error, this reduces the performance of the officer. This problem can be overcome by creating a mobile application that can record the water meter and then automatically sent via SMS messages containing customer data and water meter to the computer server to recapitulate and counting automatically, so that the officer only need to check and record water meter at customer house and then the next process will be done by the system automatically.

2. Short Message Service (SMS)

SMS is a communication service standardized in the GSM mobile communication systems, it can be sent and received simultaneously with GSM voice, text and image. This is possible because whereas voice, text and image take over a dedicated radio channel for the duration of the call, short messages travel over and above the radio channel using the signaling path. [2]

SMS contains some meta-data:

1. Information about the senders (service center number, sender number)
2. Protocol information (protocol identifier, data coding scheme)
3. Timestamp

SMS messages do not require the mobile phone to be active and within range, as they will be held for a number of days until the phone is active and within range. SMS transmitted within the same cell or to anyone with roaming capability. The SMS is a store and forward service, and is not sent directly but delivered via an SMS Center (SMSC). SMSC is a network element in the mobile telephone network, in which SMS is stored until the destination device becomes available. Each mobile telephone network that supports SMS has one or more messaging centers to handle and manage the short messages. [3]

3. Overview Of The System

Water meter record application embedded on a mobile phone that used by officers in the recording water cauge data. Fig. 1 describes the system overview of mobile application in recording water meter.

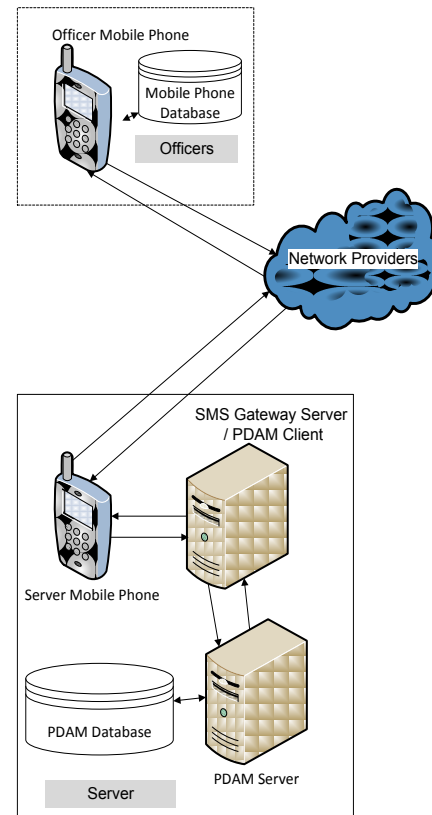


Fig 1. Overview of the system

Usability of the officer mobile phone that have been embedded by this water meter recording application are as follows:

- a. Storing the water meter data that has been written by the officer to the mobile phone database.
- b. Editing the water meter data that have previously entered to the mobile database.
- c. Deleting the water meter data that have previously entered to the mobile database.
- d. Capture images water meter.
- e. Saving an image file on the phone memory.
- f. Sending data to the mobile phone server in the form of SMS, excluding images. The image file is sent separately through mobile devices with direct connection to the computer.
- g. Displays information and notifications.
- h. Changing the settings that contain destination numbers to send SMS

Usability of server mobile phones and SMS Gateway server are as follows:

- a. Receiving SMS from officer mobile phone
- b. Checking the format of the incoming data.
- c. Sending data to PDAM server.
- d. Sending notifications message to officer mobile phone.

Usability of PDAM database and PDAM server are as follows:

- a. Calculating the incoming data.
- b. Executing queries.
- c. Storing data after calculation.

The customer data delivered to the computer server periodically. Data is sent when all the customer data have been recorder and are entered the data delivery period. If passing the data delivery period and not all the customer data is recorded, the delivery will remain to be done and the customer data that not yet been recorded, will be sent later.

Fig. 2 describes the overview of the process of sending message from officer mobile phone to server mobile phone.

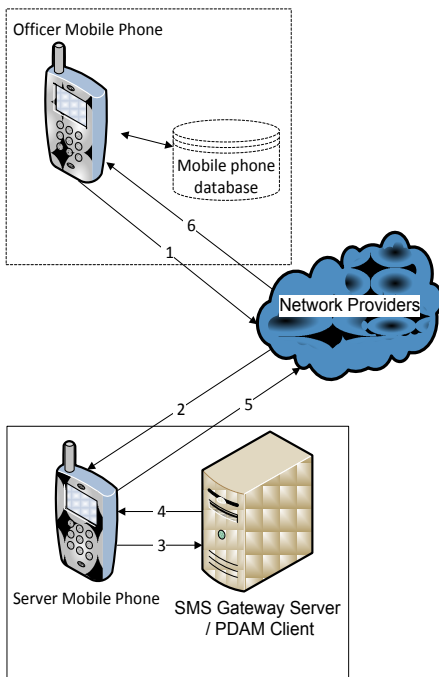


Fig 2. Overview of the process of sending the message from officer mobile phone to server mobile phone

Description of the Fig. 2 above is as follows:

1. Officer mobile phone sending message over the GSM / CDMA network provider.
2. GSM / CDMA mobile phones network providers continue to the server mobile phone.
3. Server mobile phone sending message to the server SMS Gateway computer which checks the received message then sent to PDAM server.
4. After the message has been received, the server SMS Gateway computer sending a notification.
5. Server mobile phone sending notification message over the GSM / CDMA network provider.

GSM / CDMA mobile phones network providers continue to the officer mobile phone. The delivery format adapted with the PDAM water meter, the data that sent is customer id, water meter condition and water meter value. From these data SMS format can be made like this.

```
customer_id
#water_meter_condition
#water_meter_value
```

There is kind of water meter condition, such as 1 for a good condition, 2 for moderate condition, and 3 for the poor condition. For example:

```
1#1#101
```

From the example data above, there's only one customer data, but an SMS has 160 characters at maximum, so this application dynamically combine several customer data into one single SMS until reach 160 characters. If it reaches maximum 160 characters the rest of data will be sent afterward, depending on how much customer data to be sent. Example of several customer data that sent in one single SMS:

```
1#1#101*2#3#45*3#1#167*4#2#322
*5#1#1278*6#1#453*7#1#1537*8#1#1500
*9#1#178*10#2#145*11#1#111*12#3#145
*13#1#67*14#2#222*15#1#278*16#1#543
*17#1#237*18#1#2390
```

Messages will be sent after officers pressing the send button in the application. The message from officer mobile phone will be decrypted before storing into the database. After decrypted, the data will be like the early customer data format, like customer id, water meter condition and water meter value. The decrypted data will be stored temporarily in the PDAM database. The data from officer mobile phone after decryption will be look like the Table 1 below.

Table 1: Temporary table in the PDAM database

Customer id temp	Water meter condition temp	Water meter value temp	Officer id temp
1	1	101	pt3
2	3	45	pt3
3	1	167	pt3
4	2	322	pt3
5	1	1278	pt3
6	1	453	pt3
7	1	1537	pt3
8	1	1500	pt3
9	1	178	pt3
10	2	145	pt3
11	1	111	pt3
12	3	145	pt3
13	1	67	pt3
14	2	222	pt3
15	1	278	pt3
16	1	543	pt3
17	1	237	pt3
18	1	2390	pt3

Officer id obtained from checking the phone number of officer who listed in the database. Officer id which is the sender, recorded in the temporary table. The image file only used for checking and recording evidence. The image file is sent via officer mobile phone and directly connected to the computer PDAM. Fig. 3 describes the overview process of image file synchronization.

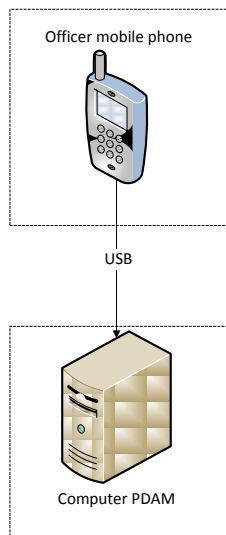


Fig 3. Overview process of image file synchronization

The image file is sent through a direct connection. The process will be done through synchronization of data and information on the officer mobile phone and the PDAM computer. The image file storage folder in the mobile phone sent to the PDAM computer and stored in the folder that has been provided as a collection of image files.

Context diagram in Fig. 4 below shows some of the entities involved in the water meter recording application.

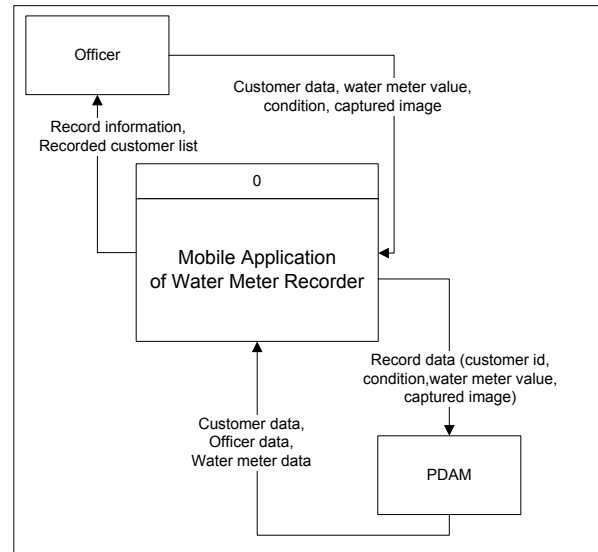


Fig 4. Context Diagram

Entities involved in context diagram in Fig. 4 above are as follows:

1. **Officer**
 Officers are system users who have full access to the system. Officers can insert data, editing data, deleting data and synchronize data.
2. **PDAM**
 PDAM is a company that has the authority to provide officer data, water meter data and customer data as the first recipient of the information from water meter record application before it is continued to the customer.

4. Experiments and Results

Trial is an important stage, because with the trial the programmer will know the error in the system. This PDAM water meter record application is made for the record officer in the process of recording the PDAM water meter every month to obtain the amount of

customer water usage. Next will explain the trial of PDAM water meter record application.



Fig 5. Login form

Fig. 5 above is the login used by officer who have permissions in the form of username and password to enter the application system. Username and password checked according username and password which listed on tb_officer, as in the Table 2 below.

Table 2: Officer table

Officer id	User name	Pass word	Phone number	Name
pt1	sby	sby	+6281917395177	Susilo
pt2	budi	budi	+6281805564983	Budiono
pt3	yusuf	yusuf	+6281999430972	Yusuf

After the login is successful, then the officer will enter the main menu. For example, officer who logged in are "Yusuf Kalla", it can be seen as the Fig. 6 below.



Fig 6. Main menu form

Fig. 6 above is the view of main menu in the PDAM water meter record application system. Can be seen "Yusuf Kalla" on the main menu form is a officer who logged in. There are seven menu, that is record, edit, view, send, list, setting and logout. Each menu have different function that will be explain as follow.

The first menu is record menu functioning as a place to input the customer water consumption data. For example, customer with a customer id "20510", which looks like Fig. 7 below.



Fig 7. Record form where customer id "20510"

Fig. 7 is a record page functioning as a place to input the customer water meter information. In this page occur an information such as customer id, customer name, customer address, class, area and the amount of water usage last month. The officer only input the amount of water usage that month, the water meter condition and capture the image of the water meter. Customer data as Fig. 7 above, taken from tb_customer as the Table 3 below.

Table 3: Customer table where customer id "20510"

Customer id	Name	Address	Class	Area
20510	KU Dusun Ketima	Dsn. Ketima	A	P022119

The information that appears on the record form where customer id "20510" can be seen as the Table 3 above. The process of capturing the water meter image can be seen as Fig. 8 below.



Fig 8. Capturing image of water meter

Fig. 8 show the process of capturing water meter image. Capturing water meter image provide evidence that the recording actually has been done to the customer. After capturing the image, image name will appear according to customer id, month and years of recording.



Fig 10. Edit form where customer id "20510"

Fig. 10 is an edit page for editing the data where customer id "20510" that has been previously entered. Only editing the data that input within this month, such as the amount of water usage this month, water meter condition, and capturing image. After save button on the menu is pressed, the data will be saved into database. Deleting data can also be performed on this page by pressing the delete button. After the data in the database is updated successful, can be seen as the Table 5 below.



Fig 9. The record page that have been filled

Fig. 9 show that all of the record data where customer id "20510" were obtained and are ready to be stored. After the save button of the menu is pressed, data will be stored into the database automatically. If the data stored in the database is successful, it can be seen as the Table 4.

Table 4: Record table where customer id "20510"

Customer id	Date	Condition	Value old	Value new
20510	12/12/2012	1	0	1530

Editing can be done in editing page, which looks like Fig. 10 below.

Table 5: Record table after updated where customer id "20510"

Customer id	Date	Condition	Value old	Value new
20510	12/12/2012	3	0	1531

Customer data where customer id "20510" changed after editing. As shown in the Table 5 above.



Fig 11. Tampilan data pelanggan dengan id "20510"

Fig. 11 is the view data page used to review the recording that have been done before. Search is performed based on customer id, month and record year. Information presented in the form in water meter condition, amount of water usage last month, this month and image file name.

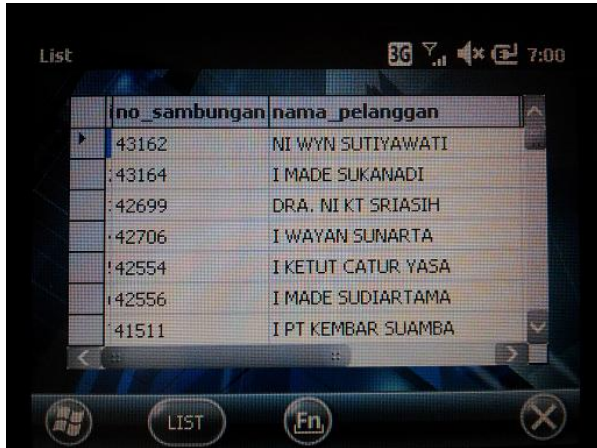


Fig 12. Sequence of recording list

Fig. 12 show list page that contains the sequence of the customer that should be record by the officer. It intend to help the officer so it's easier to choose which customer that should be noted first. Example of sequence data of recording list, can be seen as the Table 6.

Table 6: Sequence of recording list

Sequence	Customer id	Name
1	43162	Ni Wyn Sutyawati
2	43164	I Made Sukanadi
3	42699	Dra. Ni Kt Sriasih
4	42706	I Wayan Sunarta
5	42554	I Ketut Catur Yasa
6	42556	I Made Sudiartama
7	41511	I Pt Kembar Suamba



Fig 13. Setting form

Fig. 13 show the page where the record date interval is set and setting the server destination number where the data should be sent by officer.

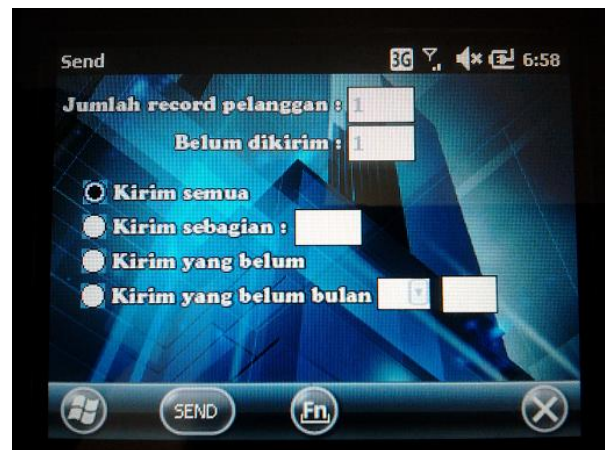


Fig 14. Menu send form

Fig. 14 is the image of send page that consist of four delivery menu, such as send all, send partially, send the delayed data and send the delayed data by selecting the month. Delivery is done by choose the delivery menu and push the send button. If the delivery is succed, a notification will appear as shown below.



Fig 15. Message sent successfully

Fig. 15 show the notification in the send page that message sent successfully. Data received on the server computer and directly decrypted then stored to the database, it can be seen as Fig. 16 below.

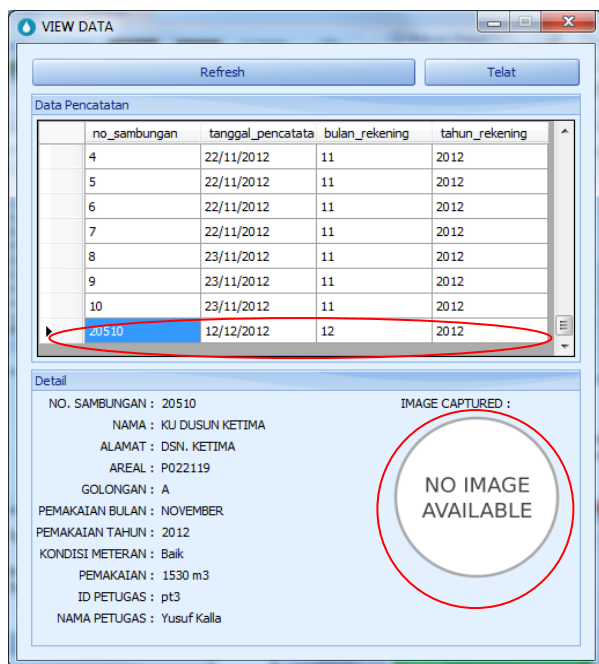


Fig 16. Record view in computer server

Fig. 16 shows that the data where customer id “20510” has been entered into a computer server database, but the picture has not yet available because the image file synchronization has not been done.

The next process is the synchronization that done on the server computer. Synchronization process can be seen as below.

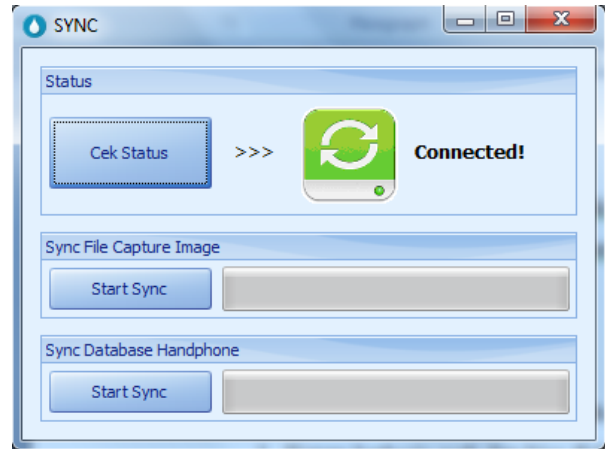


Fig 17. Sync form in computer server

Fig. 17 show the synchronization process that done on the server computer. There are two types of synchronization that can be done, the image file synchronization and database synchronization. Image file synchronization process can be seen as below.

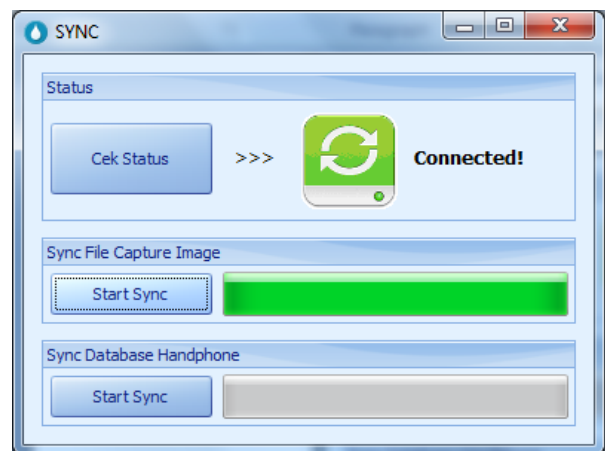


Fig 18. Image files synchronization process in computer server

Fig. 18 show the image file synchronization process. Images file in the officer mobile phone copied to server computer. After synchronization process, the image file has been copied to the server computer, it can be viewed as Fig 19 below.

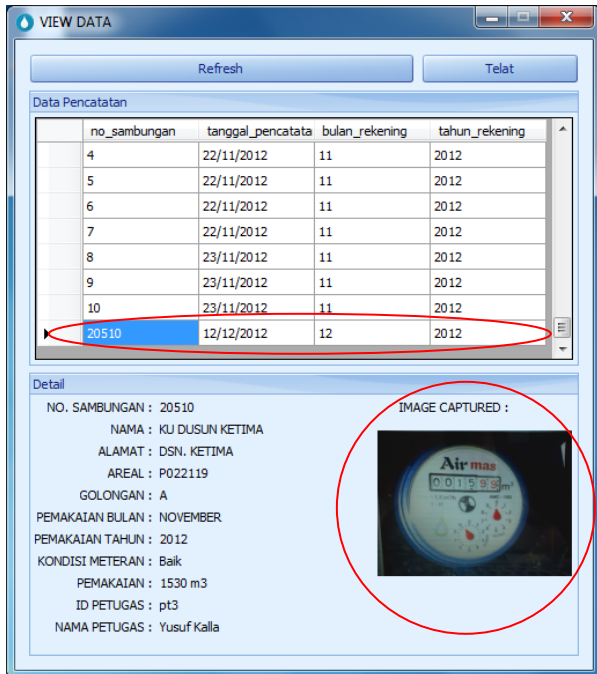


Fig 19. Image file has been copied to the computer server

Fig. 19 shows that the image file where customer id “20510” has been copied to the server computer. This can be seen from the picture above where the water meter image has been seen on the page record view.

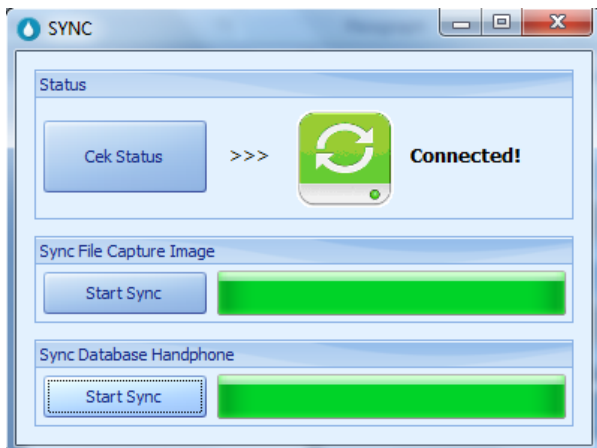


Fig 20. Database synchronization process

Fig. 20 show the database synchronization process. Database in the server computer copied to officer mobile phone.

5. Conclusions

Mobile application of water meter recorder are recorded all the information involved in the recording process, such as the officer, the water meter, the customer, the record date, and the name of the photo file when doing the documentation. Mobile application first stores all the information in the officer mobile phone database before it is sent via SMS transmission to the server.

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