



Designing an Android-Based Diabetes Health Reminder Educational Information System

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Abstract

The key to the success of diabetes management is to improve lifestyle and behavior, and the majority (more than 90%) of diabetes management activities are carried out by clients, so it is very important to conduct research to explore clients' experiences in improving life analysis), and testing the results of information systems before and after the development of information systems (analytic analysis).

The results of the study illustrate the level of adherence to the diet of diabetic patients. The study showed that 43% of patients adhered to the recommended diet. While the remaining 57% of patients do not adhere to the diabetes diet. Prevention of acute complications and reduction of the risk of long-term complications can be done if the patient is adherent to the diet so that they

patterns in order to control their blood glucose. The purpose of this study was to obtain an assessment of client compliance in routine blood glucose checks at Puskesmas Mayong II Jepara.

Methods of data collection in this study by means of observation and interviews. The variables used in this study were the completeness, accuracy, timeliness, and accessibility of the information. As for analyzing the data, it was carried out by 3 methods, namely; analysis of the system test results (content analysis), analysis of the results of interviews (descriptive

have good glycemic control. The reduction in the incidence of retinopathy, nephropathy and neuropathy is associated with improved glycemic control. Meanwhile, patients who do not adhere to a diet and are not controlled will result in a bad glycemic load, so that prevention of complications cannot be done properly.

Keywords: System Design, Diabetes Mellitus (DM), Reminder, Android

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I. INTRODUCTION

In 2013, the number of people with Diabetes Mellitus reached up to 382 million people in all parts of the world and it is predicted that in 2035 it will experience a sharp increase to more than 591 million people with Diabetes Mellitus. Meanwhile, Indonesia is in the 7th position with the figure reaching 8.5 million people with Diabetes Mellitus.[1]

In the management of Diabetes Mellitus, there are 4 main pillars, namely: counseling, physical exercise, meal planning, and hypoglycemic drugs. The main component in the success in the management of Diabetes Mellitus is nutritional therapy. Diabetes Mellitus sufferers' compliance with the principles of nutritional therapy and diet planning is one of the obstacles faced by Diabetes Mellitus sufferers. The pattern of the right amount of food for diabetes mellitus sufferers and the type of food recommended for these patients many people with diabetes mellitus complain about because they feel too heavy and tortured, but they must be implemented. A study was conducted in 2007 by Setyani whose contents of the study described the adherence to a healthy diet for Diabetes Mellitus patients. From this research, it was found that only 43% of diabetes mellitus patients were obedient to their diet. Meanwhile, the rest were 57% diabetic patients who did not adhere to the recommended diet.[2]

II. LITERATURE REVIEW

2.1 Health visit reminder (HEAVIER)

HEAVIER is an application that provides health services in the form of patient reminders to control their health.

Patients are advised to monitor their blood glucose levels independently (self-monitoring of blood glucose = SMBG). This will greatly help patients to be able to find out their blood sugar levels at any time, so that patients know the ups and downs of blood sugar levels, including knowing if hypoglycemic complications arise early. The frequency of SMBG depends on each individual, depending on the type of diabetes, type of therapy, adequate glycemic control, awareness of hypoglycemic conditions, busy work of the patient, and acute illness. It is recommended that diabetes patients, both type 1 and type 2 who use MDI (multi-dose insulin) therapy or an insulin pump, have to check their blood sugar levels 3 or more times a day, that is, after each meal (main meals and snacks), want to sleep, during physical exercise, and when they want to do certain activities such as driving a vehicle. Meanwhile, for people with type 2 diabetes, whether they use drugs or not, it depends on the needs of each individual. It has been shown that blood glucose control is better in patients who apply SMBG than those who don't. Therefore, this situation is quite interesting for researchers to conduct research on the Independent Preventive Data Recording System by People with Diabetes Based on the Integration of Android Applications with the SMS Gateway.[3]



2.2 Framework for the Application of Sistem Thingking (Fast)

The Fast method is a methodology used to develop and maintain an information system.

According to [4] The Fast method starts with the System Analyst Software, Engineer and Programmer. To build a system, there are several stages, namely the preliminary study stage, problem analysis, needs analysis, logical design, decision analysis, physical design & integration, construction & testing, installation & delivery.[4]

2.3 Android

Android is an operating system on linux-based cellular phones. which has an open platform. in the andoid system we can develop and create their own applications that can be used in mobile devices.[5]

III. RESEARCH METHOD AND DESIGN

3.1 Research Place

This research was started on February 21 to March 21 2019, by conducting a preliminary study on November 18 2018. This research has been declared eligible and received approval from the ethical committee of the Faculty of Public Health, Diponegoro University Semarang with Number. 37 / EA / KEPK-FKM / 2019.

3.2 Research Design

The methodology used in the Health Visit Reminder Information System Design is using the Fast method. The stages in the Fast method consist of seven stages: preliminary study, problem analysis, needs analysis, logical design, decision analysis, physical design & integration, construction & testing, installation & delivery. [6]

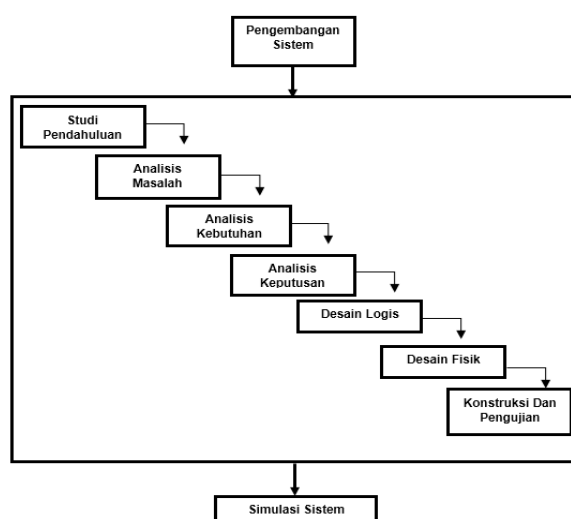


Figure 1. Concept Framework



3.3 Research Subjects

The subjects studied for the development of the information system were all people involved with this Information System, namely the head of the Mayong II Jepara Community Health Center and the Health Officers in it. The criteria for selecting the subjects of this study included having predetermined conditions related to this study, then having an eligibility attitude, being willing to participate, and taking an active role in this study. The subjects of this study were 21 people. These 21 people consist of direct and indirect users of the reminder system. Users of direct reminder system include 1 expert computer operator as well as 16 Diabetes Mellitus patients. Meanwhile, users of the indirect reminder system include 1 officer in the registration section, 1 polyclinic doctor, 1 polyclinic nurse, and also the Head of the Mayong II Jepara Community Health Center. Meanwhile, purposive sampling is the method used in selecting the subject.

3.4 Types and data collection techniques

Field observations and in-depth interviews are the methods used for data collection. The results of in-depth interviews, field observations and documentation can then be analyzed data at the reminder information system development stage by means of content analysis used to analyze the qualitative data of this study. The qualitative data of this study were selected based on their relevance and set out in a narrative form. The longitudinal approach was used in this study because based on the research unit it was carried out more than once in a certain duration of time, while the approach regarding information quality consisted of completeness of information, accuracy of information, accessibility of information, and validity of the information.[7]

3.5 System Design

System design in this study starts from database design. According to. [6] The database is the most important component that functions to support information systems. The next stage is data normalization, making Context Diagrams, Data Flow Diagrams (DFD) and Entity Relationship Diagrams (ERD). [8]

Then performed a system simulation. Data Flow Diagrams (DFD) or Data Flow Diagrams (DAD). DFD is a series of diagrams that describe the activities that exist in a system in which there is a relationship between existing data. DFD manufacturing technique is described with a context diagram or DFD level 0 and is continued with the analysis of each part, namely DFD level 1, DFD level 2 and so on.[9]

Meanwhile, Entity-Relationship Diagram (ERD) is an initial modeling of the database structure that will be developed to answer the relationship between other data.[10]

3.5 Results Analysis Techniques

From the simulation results of the HEAVIER information system built using the Fast method. conducted an in-depth analysis. the conclusions will be drawn from the research results.



IV. ANALYSIS RESULTS AND SYSTEM DESIGN

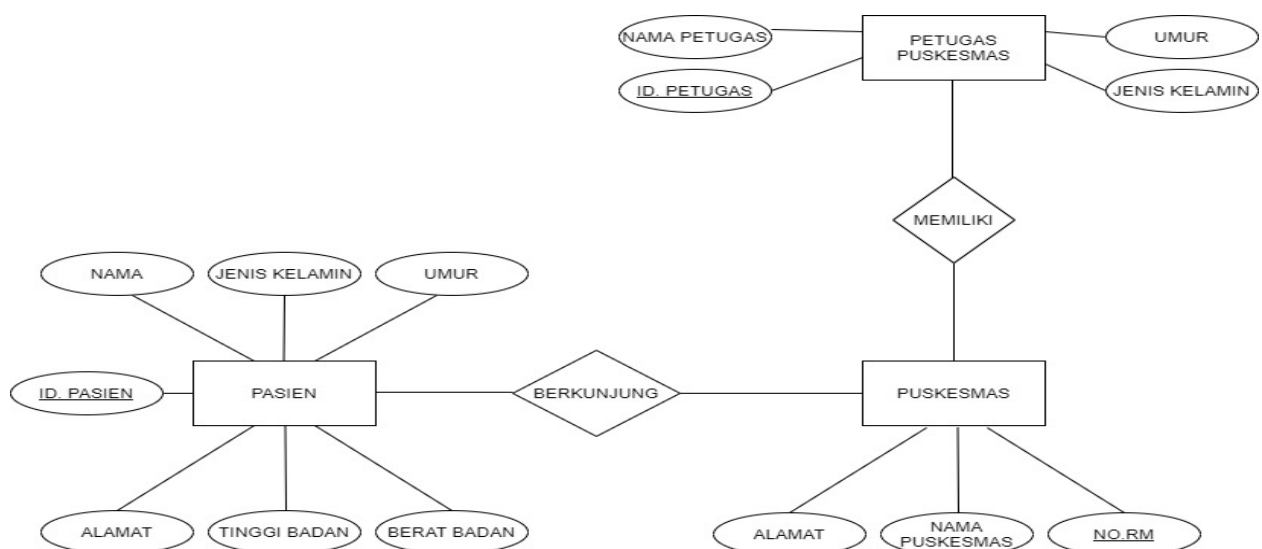
4.1 Results of System Design Analysis

The first step in the HEAVIER Information System Design is to conduct problem analysis and needs analysis. This is done through a process of in-depth interviews and observations at the research location. by conducting interviews and observations in accordance with the needs in designing the HEAVIER Information System. this can be seen from the flow of the HEAVIER system that is currently running. it is necessary to take steps that are more systematic and structured to design a new information system. From the stages and the results of the analysis, it is known that the need for a well-computerized HEAVIER information system from users, administrators and networks so as to improve the quality of health services and management of Diabetes patients so that patients can control their diet and blood sugar programs.

The design of this system is built with the Java Script programming language and the database uses Firebase. This system is developed based on Android.

Firestore is a service from Google that is used to make it easier to develop applications. As well as to facilitate the system design process, it is necessary to establish relationships with the entities and attributes used. flow and system processes used in the system, it is necessary to design an ERD, context diagram and DFD. [11]

The ERD in the Health Visit Reminder information system can be seen in Figure 2.



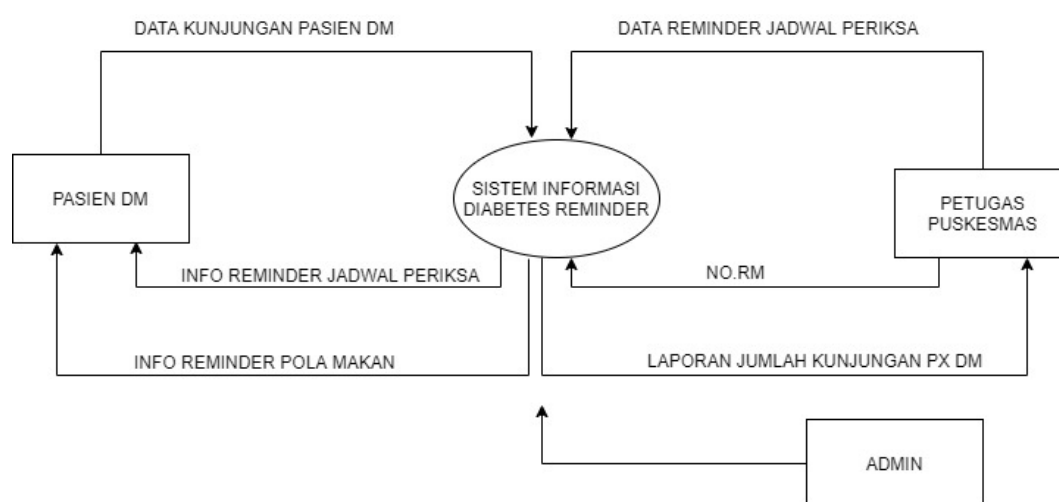
ERD



Figure 2.ERD BES 119

Figure 2 Describes an overview of the relationships and entities that exist in the HEAVIER system.

Furthermore, a context diagram is made to explain the data and information that enters and leaves the system. this can be seen in Figure 3.



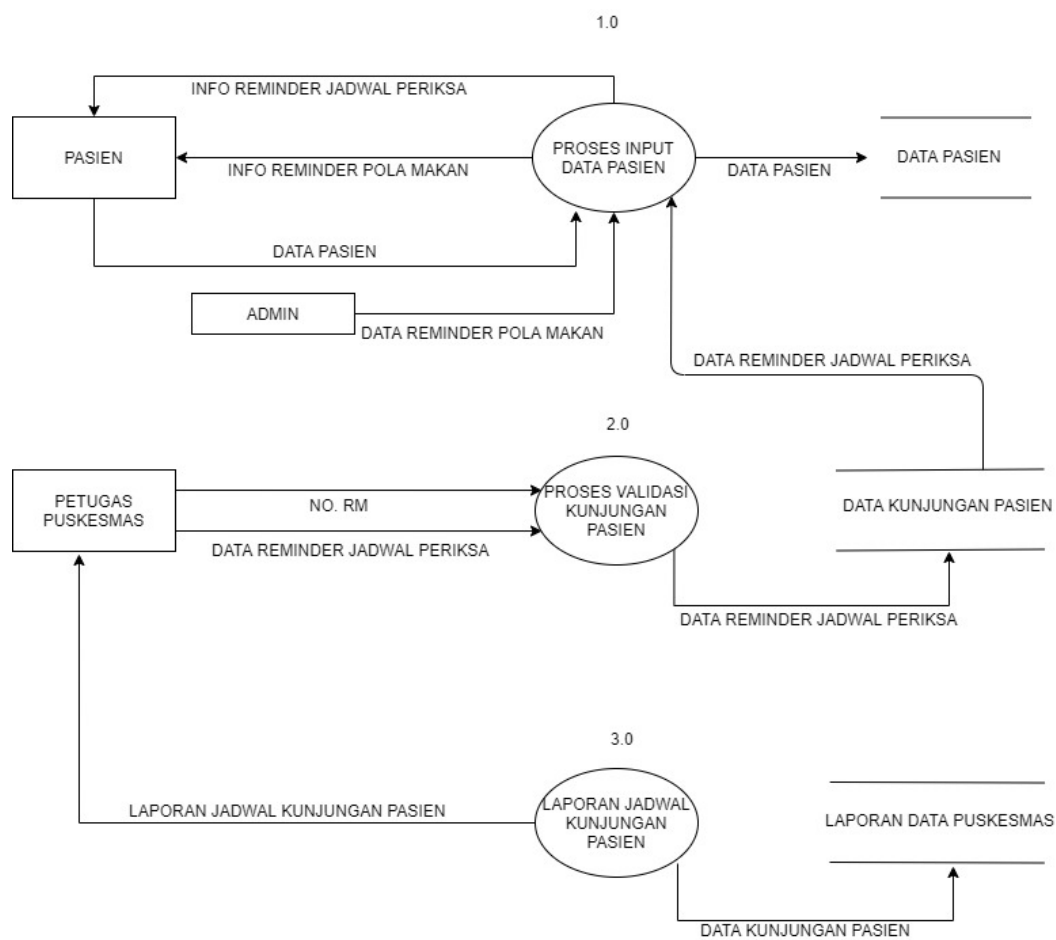
DFD 0 / DIAGRAM CONTEXT

Figure 3. Context Diagram.

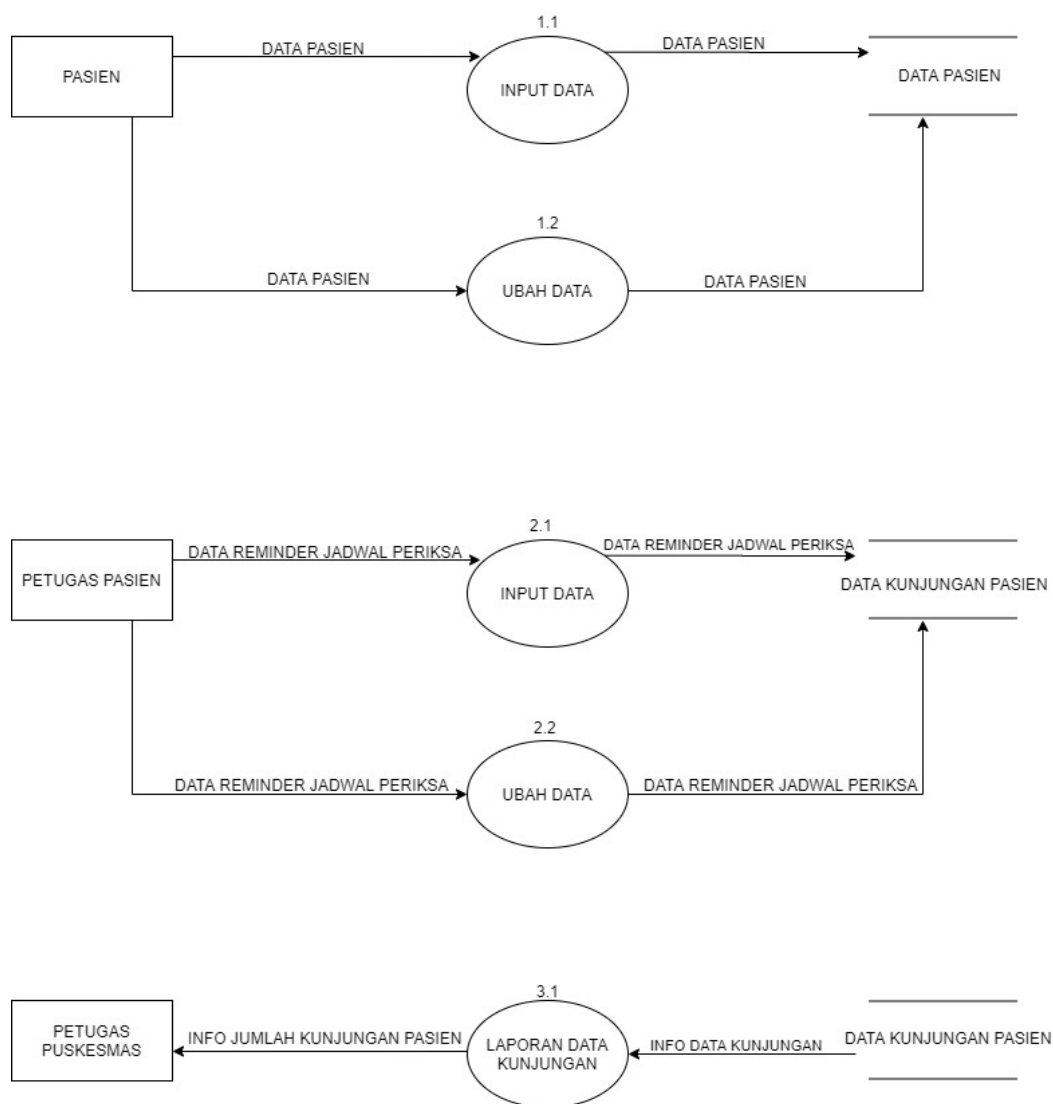
An overview of data relationships in the system and processes that occur in the system can be seen in the Data Flow Diagram (DFD). [8] Can be seen in Figure 4.



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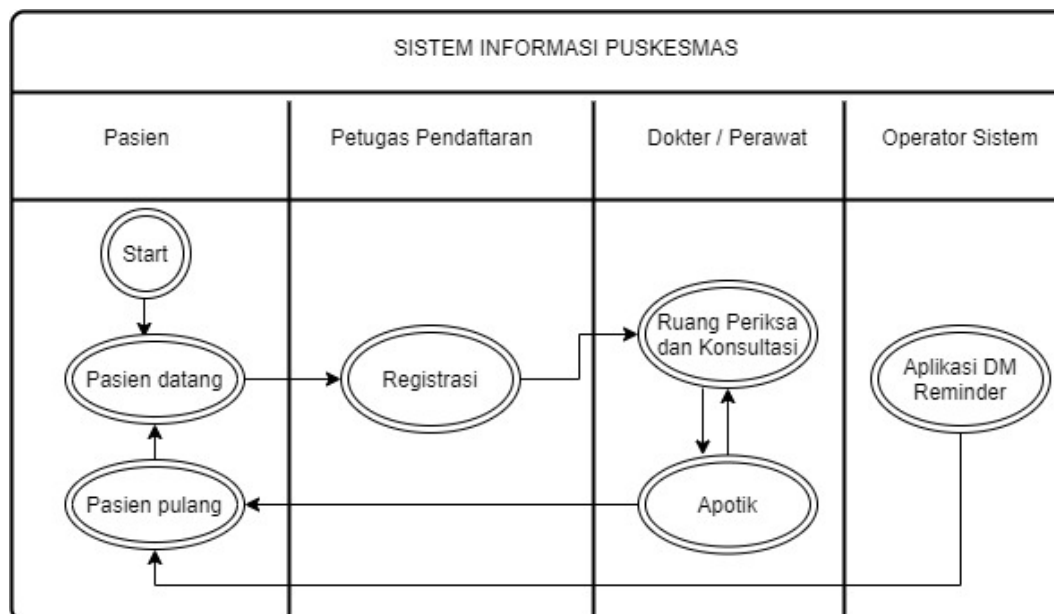


DFD LEVEL 1



DFD LEVEL 2

Figure 4. DFD



HEAVIER Reminder Information System Flowchart

No.	Message Design	Components
1.	Ethics	Greetings Formality and politeness of language Thank you Sender's identity
2.	Simplicity of Shape	Sms content is clear and precise Easy to understand Not too long
3.	Time and Frequency	Delivery when not busy Delivery as needed
4.	Message Variations	a.Introduction b.Reminder control c. Health information - DM handling - Check blood sugar levels - Diet - Diet menu - Sports - Take Medicine - Side effects - Complications - Stress prevention - motivation

Design Drawing Reminder Message



4.2 System Design Results

User Interface is a graphical display that can be understood by computer users and programmed in such a way that it can be read by the computer operating system and operates properly. With the user interface, users can easily input and output data and manipulate / manipulate data as needed. [12]

The following is the HEAVIER Information System user interface based on Android. Inter-design in this system using Bootstrap. The HEAVIER user interface is designed using an Android-based platform. The Android platform consists of two user levels including User and Admin, while Hosting-based administrators.

The Interface Design can be seen in the image below.





Sidr rev 191119.apk

2,28 MB | 20/11/19 05.48



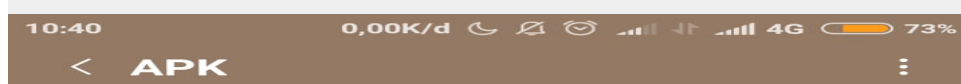
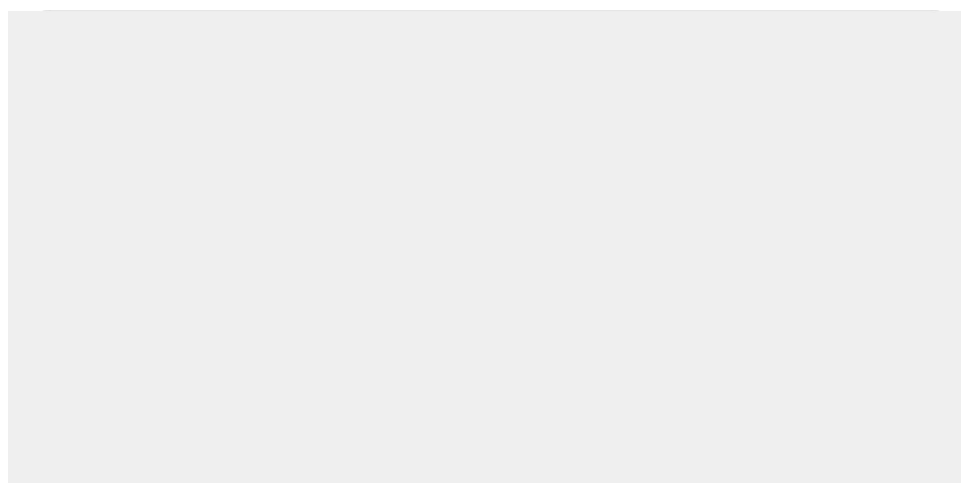
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Sidr.apk

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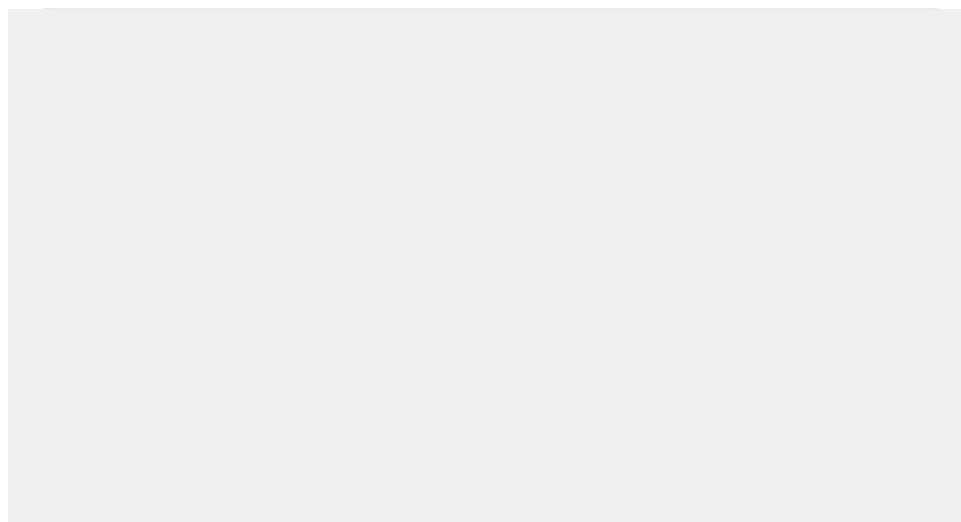
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Sidr.apk

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20:36 0,00K/d 4G 86%

< PHHHOTO

-----SMS/MMS-----

11-9-2019 23:19

Anda Mempunyai Jadwal Kunjungan Ke 'RSI Kudus' pada tanggal '[2019-09-11](#)' [FREE SMS DEMO, TEST MESSAGE]

14-9-2019 22:59

Anda Mempunyai Jadwal Kunjungan Ke 'RSI Kudus' pada tanggal '[2019-09-11](#)' [FREE SMS DEMO, TEST MESSAGE]

+ Pesan teks 1 >

5:19 1,78K/d 4G 17%

KALKULATOR BMI

Berat Badan :

40

Tinggi Badan :

1.5

Hasil

KURUS

kekurangan berat badan ringan

Powered by 000webhost

The image displays two screenshots of a mobile application titled 'KALKULATOR BMI'. The top screenshot shows a user inputting a weight of 42 and a height of 1.5, resulting in a 'NORMAL' BMI status. The bottom screenshot shows the same weight input but with a height of 1.6, resulting in a 'SANGAT KURUS' (Very Thin) BMI status. Both screens include a 'Hasil' button and a footer indicating they are powered by 000webhost.

KALKULATOR BMI

Berat Badan :

42

Tinggi Badan :

1.5

Hasil

NORMAL

Powered by 000webhost

KALKULATOR BMI

Berat Badan :

42

Tinggi Badan :

1.6

Hasil

SANGAT KURUS

kekurangan berat badan banget

Powered by 000webhost



The image displays two screenshots of a mobile application titled "KALKULATOR BMI". Both screenshots show a form with two input fields: "Berat Badan :" (Weight) and "Tinggi Badan :" (Height). A blue button labeled "Hasil" (Result) is positioned below the height field. The result "NORMAL" is displayed in large, bold, black letters at the bottom of the form. The top screenshot shows a weight of 45 and a height of 1.50, with a status bar at the top indicating 7:19 and 44% battery. The bottom screenshot shows a weight of 45 and a height of 1.55, with a status bar at the top indicating 6:09 and 43% battery. Both screenshots include a "Powered by 000webhost" watermark at the bottom.

KALKULATOR BMI

Berat Badan :
45

Tinggi Badan :
1.50

Hasil

NORMAL

Powered by 000webhost

KALKULATOR BMI

Berat Badan :
45

Tinggi Badan :
1.55

Hasil

NORMAL

Powered by 000webhost



3:54 ... 0,00K/d 4G 57%

KALKULATOR BMI

Berat Badan :

50

Tinggi Badan :

1.5

Hasil

NORMAL

menu makan:
pagi:
nasi, ikan, tempe, sayuran

23:34 ... 0,05K/d 4G 54%

KALKULATOR BMI

Berat Badan :

50.5

Tinggi Badan :

1.6

Hasil

NORMAL

menu makan:
pagi:
nasi, ikan, tempe, sayuran



6:12 0,02K/d 4G 43%

KALKULATOR BMI

Berat Badan :

60

Tinggi Badan :

1.7

Hasil

NORMAL

Powered by 000webhost

The image displays two screenshots of a mobile application titled 'KALKULATOR BMI'. The app interface is white with a grey header and footer. The top screenshot shows a weight of 61 and a height of 1.69, resulting in a 'NORMAL' status. The bottom screenshot shows a weight of 65 and a height of 1.7, also resulting in a 'NORMAL' status. Both screens include a blue 'Hasil' button and a 'Powered by 000webhost' watermark. The status bars at the top of each screen show the time, data usage, signal strength, and battery level.

KALKULATOR BMI

Berat Badan :

61

Tinggi Badan :

1.69

Hasil

NORMAL

Powered by 000webhost

KALKULATOR BMI

Berat Badan :

65

Tinggi Badan :

1.7

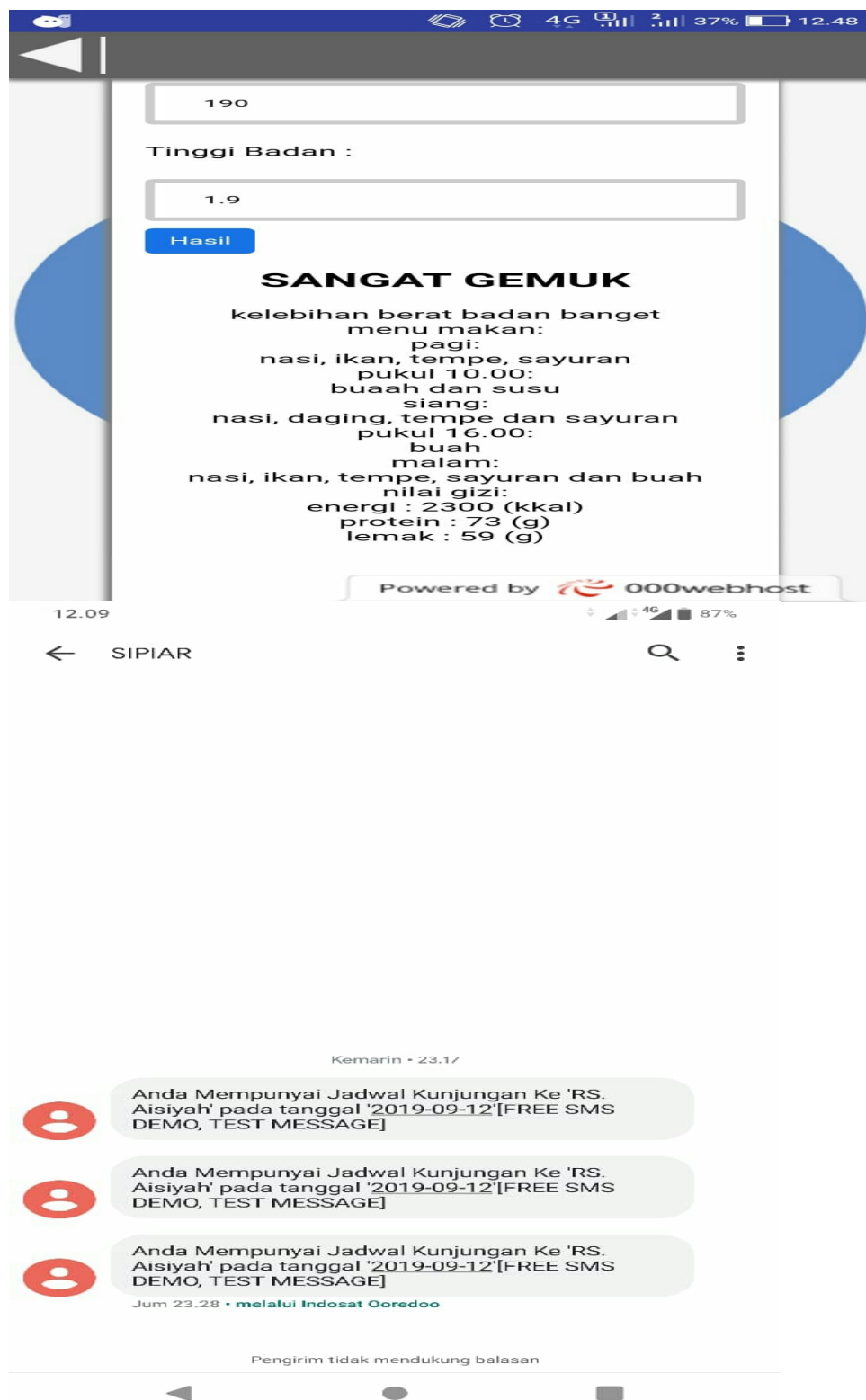
Hasil

NORMAL

menu makan:
Powered by 000webhost
nadi



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Picture. HEAVIER Application Menu Display



4.3 System Testing and Simulation

Before testing the new system, system users are asked to fill out a questionnaire to measure the quality of the information system against the system prior to development. You can fill it in by entering a value from one to four next to the question. Each score has its own meaning, namely: 1 = Strongly Disagree 2 = Disagree, 3 = Agree and 4 = Strongly Agree. After testing the HEAVIER Information System, the user will then be asked to fill out a new closed questionnaire to find out and measure the quality of the new system information with the same procedure as when testing the quality of the old information system. Then calculated the value of the difference in the quality of information before and after development using the Linker Scale.

Table 1 Results of Information Quality Measurement Recapitulation

Based on the results of observations of the reminder system output in the form of a reminder report and visit reports, the patient visit compliance data after sending the reminder SMS is shown in the following table:

SMS Delivery Status	Visit Status						Total	
	Come				Not Coming			
	On Schedule		Not On Schedule					
	n	%	n	%	n	%	n	%
Sent (+)	11	68,8	2	12,5	2	12,5	15	93,8%
Undelivered (-)	0	0	0	0	1	6,2	1	6,2
Total	11	68,8	2	12,5	3	18,7	16	100

Based on the table above, it can be seen that the majority of patients who were sent SMS reminders came to visit the clinic, as many as 13 people (81.3%) consisting of 11 patients (68.8%) who came on schedule and patients came but not on schedule as many as 2 people (12.5%) while only 2 patients who did not come after sending SMS reminders (12.5%). The data also shows that 1 patient (6.2%) had undelivered SMS status did not come to visit the clinic. Based on this, sending SMS reminders can be a strategy to support patient compliance in controlling their health to the Diabetic Center Clinic.

In randomized controlled trials the reminder system has been shown to have benefits for patients and to be a cost effective method of supporting healthcare professionals. Hussein et al. (2011) have evaluated the feasibility of using SMS between clinical visits that have a positive effect on blood glucose control in patients with type 2 diabetes. Heatley et al. (2013) proved that the SMS reminder system is an effective method of increasing the attendance of women with gestational diabetes to follow.



V. CONCLUSION

Design of a reminder system is needed at the Alifa Diabetic Center Clinic because it supports the treatment surveillance program for diabetes mellitus patients. Information sent via SMS must be tailored to the patient's needs. The content of SMS reminders sent to patients must pay attention to ethics, simplicity of form, time and frequency of delivery and variation of messages. The system focuses on setting and sending SMS so that it can send SMS manually or automatically.

The reminder system produces monitoring report output, visit reports and reminder reports that help the clinic monitor patients who are in outpatient conditions. The output of the reminder system report shows that 81.3% of patients visit the clinic after being sent an SMS reminder so that the use of a reminder system can be recommended as one of the strategies to improve treatment adherence to diabetes mellitus patients.

For further development, the suggestions that can be given are:

1. It is better if the registration officer asks the patient for the latest cellphone number if he has changed the cellphone number
2. The reminder system can be developed by adding features to direct consultation services with doctors because this system can be done in two directions.
3. Health information messages sent to patients must always be updated so that patients get more varied information about diabetes mellitus management and activities in clinics related to DM disease management.
4. It is advisable for further research to be evaluated to measure the effectiveness of the system in improving treatment adherence to diabetes mellitus patients using a quantitative research design, namely a randomized controlled trial.

VI. THANK-YOU NOTE

We would like to thank Puskesmas Mayong II Jepara for giving permission to carry out this research. and thanks to the Diponegoro University Public Health Study Program for their support in completing this research.



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