

# Health Services Monitoring System Based on Web-GIS for Puskesmas

Istikmal, Tody Ariefianto Wibowo, and Leanna Vidya Yovita

**Abstract**—Puskesmas in Indonesia has a very important role for the public health improvement and as a spearhead to running the government health program, besides hospital. Existence of Puskesmas can be optimized by leveraging information technology so that people could easily find information about Puskesmas and government can more easily monitor both the performance and the development of Puskesmas. This research was the second phase development of SIGAPNAS application that have been made, using the city of Bandungas study case. This application is a WebGIS based information system for Puskesmas. In this second phase, beside general information, personnel and equipment health and condition of Puskesmas, has been added the function of monitoring the type and category of Puskesmas as well as complementary information for health professionals. This application is expected to help improve the role of Puskesmas, and ultimately improve public health and facilitate the government in monitoring the level of health services in Puskesmas.

**Index Terms**—Puskesmas, SIGAPNAS, WebGIS.

## I. INTRODUCTION

Puskesmas is one of the government-owned health facilities spread across Indonesia. The existence of Puskesmas is very important for the government in providing health services throughout community due to appropriate health legislation in 2009 [1]. No less than 9,152 Puskesmas that exist today [2].

Today information technology is growing rapidly, but on the contrary existence of Puskesmas and health programs that are provided are not easily known by the public, this is because Puskesmas has not been provided with information technology such as the internet. It is also supported by the RIFASKES (Research Facility Health) results there are the availability of computers in urban community Puskesmas as much as 97%, while in the countryside as much as 79% [2]. So the use of the internet and communication technology in Puskesmas is very likely applied.

To bridge the gap between government programs through Puskesmas and the provision of access to information about the location and health services, in this research created a prototype application named SIGAPNAS (*Sistem Informasi Geografis Puskesmas Nasional*). This research was funded by the Ministry of Education through a competitive grant. In first stage SIGAPNAS has been develop to provide information surrounding Puskesmas and get information on the location, availability of health services

such as medical and health personnel, and condition of Puskesmas. This research developed the second phase of the SIGAPNAS application for strengthen monitoring function for the government to monitor the progress of health services and the success of the program in Puskesmas.

Besides providing information about the availability of health workers such as doctors, dentists, nurses, and building conditions, this application was developed to be able to monitor the types of Puskesmas, PONE or non PONE as well as non-perawatan or perawatan category, also number of health professionals such as midwives, sanitarians, and nutrition consultant.

PONE (neonatal emergency obstetric care basic) is a Puskesmas that has the facilities and the ability to provide services to handle emergency obstetric and neonatal care case for 24 hours. Puskesmas perawatan is a Puskesmas with an added room and facilities for people with emergency help, either in the form of limited operative measures and temporary hospitalization.

The distinction is the type and category of Puskesmas will indicate the level of service and the ability of Puskesmas in addressing the health needs of the community. More and more Puskesmas are PONE and perawatan showing care and ability levels are getting better.

Such applications are expected to help the public, government, and Puskesmas itself in optimizing the role of Puskesmas in improving the health of the people of Indonesia [3], [4] and fulfill the government standard criteria [5].

This application latter be expected to assist the government in RIFASKES program to record and monitor the condition of Puskesmas. Entered data are temporal data from the RIFASKES program in 2011 and will be updated based on the results of the survey. Future, the data will be updated directly by each Puskesmas after it is implemented.

## II. METHODOLOGY AND DESIGN

### A. Methodology

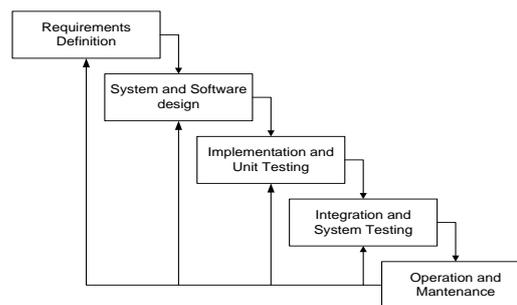


Fig. 1. Waterfall Methodology [6], [7].

In SIGAPNAS first and second stage application

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development, waterfall methodology was used. In the early stages, system requirements analysis was done prior to system design and software, Analysis of the system needs to be reviewed based on existing data and the survey results.

Next step, data pre-processing was done, then do the implementation and testing of software design, the final step was software development, perform the integration, testing and operation system maintenance. Stages of the methodology used could be seen in Fig. 1 [6], [7].

**B. Design**

Information system Puskesmas SIGAPNAS design provides information on the availability of health personnel, medical equipment, location, type and category of Puskesmas, as well as general information, which can be seen in the fishbone diagram in Fig. 2. In this stage we focus on developing monitoring function type and category of puskesmas, also complete the health personnel for midwife, nutrition consultant, and sanitarian [8].

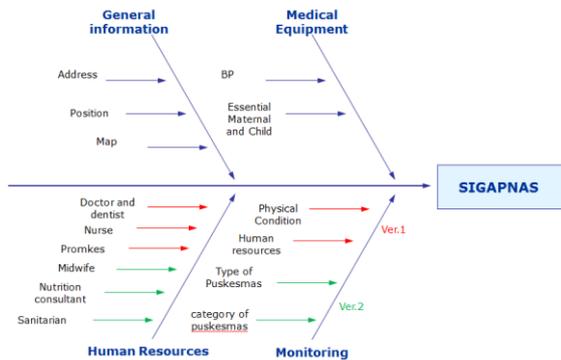


Fig. 2. SIGAPNAS fish bone diagram [8].

**III. RESULT AND DISCUSSION**

Display “welcome SIGAPNAS” will appear when the application is accessed through the web, as shown in Fig. 3 Once users log into the application SIGAPNAS, as shown in Fig. 4, it will presenting the various menu functions of the application such as Puskesmas search function, tracking, raise and eliminate health center mark on maps and information about the application.



Fig. 3. Initial menu display.

Users can search for Puskesmas information based on the geographical locations that have been marked on the map as shown in Fig. 5. Furthermore, the public can directly access information on Puskesmas as marked on the map. In the first stage we show examples Puskesmas Tamblong while in the second phase Puskesmas Balai Kota information is presented.

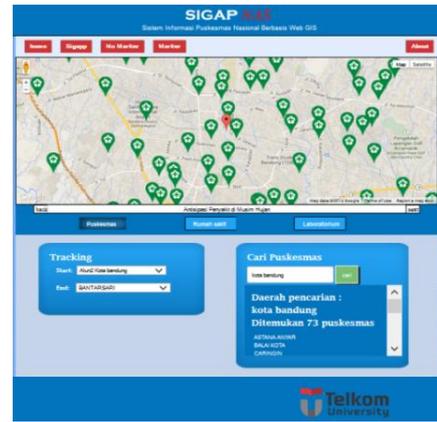


Fig. 4. Puskesmas information search function.



Fig. 5. Puskesmas information on map marking.

When users access the link, it will display the menu of each Puskesmas which contains general information on the Puskesmas, including name and ID Puskesmas, type and category of Puskesmas, Building condition, community Puskesmas address as shown in Fig. 6.



Fig. 6. Puskesmas general information.

Information function that appears on the map to facilitate the users in finding the information needed. Fig. 7 describes how to bring information PopUp Health Center, used the source code on the web as follows:

```

var locations = [
  <?php
  $count=1;
  foreach ($data_puskesmas->result() as $dp){
    ["<div style='float: left;text-align: left;'><b style='font-size:
    20px;'>Puskesmas <?php echo $dp->nama_puskesmas
    ;?></b><br><?php echo $dp->alamat;?><br><img src='<?php echo
    base_url()>images/logo_small/Contact.png' /><?php echo $dp-
    >nomor_telepon ;?><br><a class='show_puskesmas'
    onclick='show(<?php echo $dp->nomor_urut_puskesmas ?>)'>Lihat
    selengkapnya</a></div>";<?php echo $dp->latitude ;?><?php
    echo $dp->longitude ;?>,<?php echo $count ;?>];
    <?php
    $count++;
  }
  ?>
];
    
```

Fig. 7. Web code for the function PopUp.

Beside general information, public can see the availability of health workers at Puskesmas, as shown in Fig. 8. This information is also very helpful for the government to monitor and evaluate the availability of health workers in Puskesmas.



Fig. 8. Health workers information.

Another thing that is important is the availability of medical equipment. In this application only included basic standard medical devices, which are medical devices “esensial BP umum” and “esensial kesehatan ibu anak” [8]. For future development does not rule out the possibility there will be new information about health equipment.



Fig. 9. Medical equipment availability information.

Availability and completeness of medical equipment in health centers is very important in providing optimal health care to the community. Fig. 9 shows the availability of medical equipment, from this information the communities and governments can assess the readiness of Puskesmas in providing health care. The government should pay attention and perform periodic monitoring of the availability of medical equipment in Puskesmas.

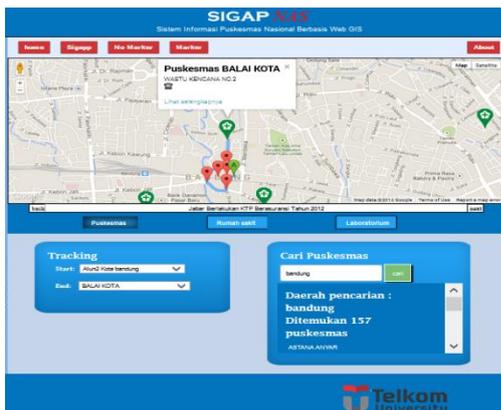


Fig. 10. Tracking function.

Another application function is tracking, so that users can find a route to health centers of the selected location. Could be seen in Fig. 10, the route from Bandung city center to the Puskesmas Balai Kota. This will allow people to get to the clinic in question.

Both in version 1 and version 2, SIGAPNAS also could be used for monitoring Puskesmas condition and updating Puskesmas information. These activities can only be done by the Puskesmas admin. Fig. 11 shows the login menu for admin [8].



Fig. 11. Admin and government login page [8].

There are settings and additional information in the form of a list of all Puskesmas in the system, the presentation of information in the form of statistical charts, and information-based WebGIS [8]. To access this function the user must have a username and password. In Fig. 12, admins could add new Puskesmas users, so that the user can update the Puskesmas data.



Fig. 12. User menu [8].

Admin and the government users could do addition and subtraction number of Puskesmas and perform data change, User can also search by code or by city for Puskesmas, as shown in Fig. 13.



Fig. 13. List of Puskesmas in the system [8].

To view information about the availability of equipment and health workers in Puskesmas at the district level to provincial can be used statistical menu functions, could be

seen at Fig. 14. This chart information function enables users and government the data observed at the level of districts, cities, and provinces. To make it easier to see the fulfillment of the established standards compared to availability of personnel and medical devices using threshold function [8]. In the graph shows there are Puskesmas that do not have midwife and equipment scales for infants.

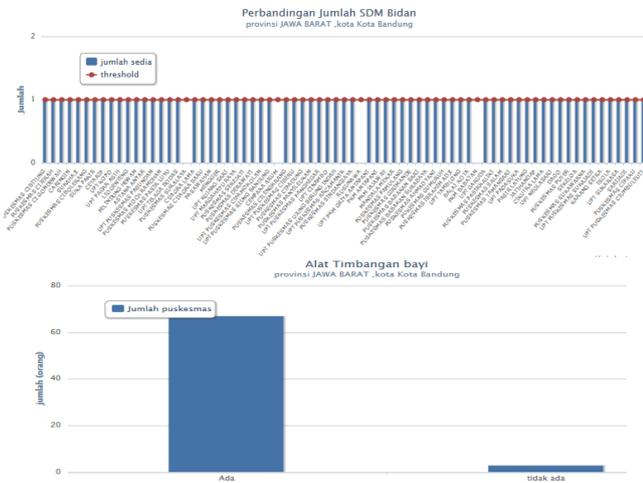


Fig. 14. Graphical information SIGAPNAS.

Fig. 15, shows a graph of information that the number of PONED and non PONED Puskesmas. Most of the Puskesmas in the city of Bandung still non PONED criteria, this should be a concern of government, and of course it is the impact on health care, especially of an emergency.

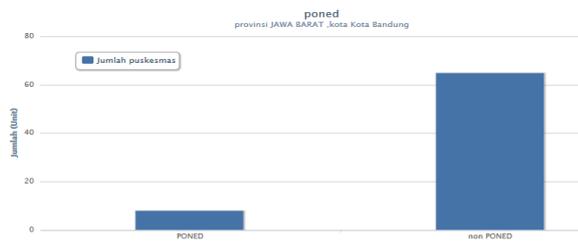


Fig. 15. Information graphical type of Puskesmas.

At this second phase of development, WEB GIS information system for health workers has been fitted, which include physicians, dentists, nurses, midwives, nutrition consultants, sanitarians, and Promkes. In the first stage monitoring system of Puskesmas buildings condition has also been made. To assist the government in monitoring the level of service in Puskesmas, at this second phase we add the monitoring function type and category of Puskesmas, so that the overall monitoring functions include: Health workers (human resources), Conditions of Puskesmas, Types and category of Puskesmas.



Fig. 16. Midwife monitoring in WEBGIS.

Availability of midwives in the city of Bandung quite well where there is only one Puskesmas that does not have a health center midwife just as shown in the Fig. 16, but for the nutritionist is still quite a lot of Puskesmas that do not have it, from Fig. 17 it appears there are about ten Puskesmas without nutritionist.



Fig. 17. Nutrition consultant monitoring in WEBGIS.

The government could do Puskesmas monitoring through this application for the availability of sanitarian in Bandung city. In Fig. 18, there are about 15, or about 20.5% Puskesmas in the city of Bandung has no sanitarian.

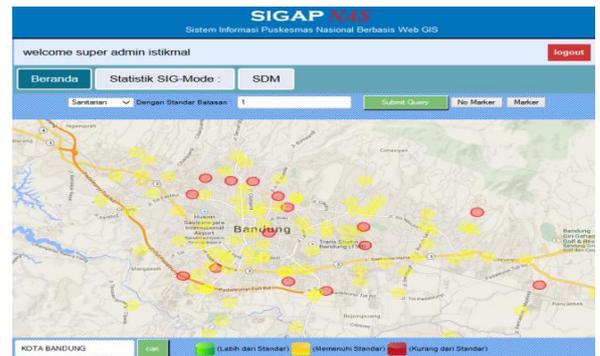


Fig. 18. Sanitarian monitoring in WEBGIS.

To optimizing health care in government's Puskesmas must meet and add health workers in each Puskesmas, because if the health personnel standard increasing to be minimum two people, then certainly almost all Puskesmas do not meet these criteria.

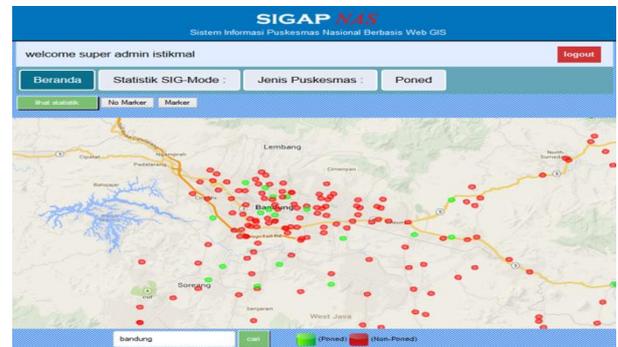


Fig. 19. WEBGIS type of Puskesmas.

PONED is basic emergency obstetric care neonatal, where Puskesmas with the type of facility have the ability to provide emergency obstetric and neonatal care. In this case the government must pay attention and keep on improving Puskesmas PONED types. Fig. 19 shows WEB GIS information of the type existing Puskesmas in the city of

Bandung, the majority still in non PONED type.



Fig. 20. WEBGIS Puskesmas Category.

In addition there is also a kind of Puskesmas into class categories of Puskesmas *perawatan* and *non-perawatan*. Puskesmas *perawatan* have the ability to provide health services to inpatient care if needed. Inpatient services are indispensable in a location away from the hospital and for people with weak economic conditions that are not able to pay for inpatient care in a hospital. From Fig. 20 we could see that the majority of the categories of Puskesmas in the city of Bandung is a non-perawatan it must be the concern of government and the Puskesmas to improve their level category become perawatan, particularly in the areas where the hospital has little number. Fig. 21 shows Puskesmas Category in Graphical Comparison that provided in the application.

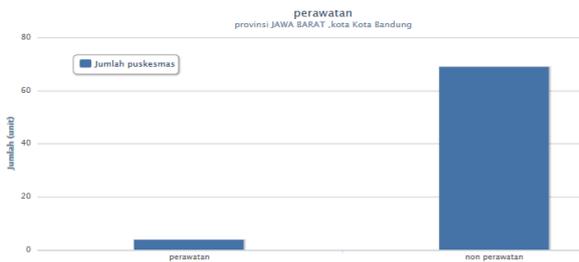


Fig. 21. Puskesmas Category graphical comparison.

Fig. 22 shows WebGIS functions that have been developed in first stages the monitoring of the physical condition of the Puskesmas. It is divided into three tiers which are slightly damaged, moderately damaged, and heavily damaged.



Fig. 22. WEB GIS Puskesmas building condition [8].

#### IV. CONCLUSION

SIGAPNAS application based on WebGIS in second phase, beside allows people to find information about puskesmas, it can also assist governments in monitoring the level of health care and development. Government, Puskesmas and community is expected to utilize these applications to improve public health and help realize the government's health programs. Data will be updated based on the results of the survey and next step will be entered directly by the puskesmas operator. This application will continue to be improved and developed.

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