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The Architecture of e-Notification Utilizes Short Message Service to Improve Community Health Centers Services

Rendra Gustriansyah, Nazori Suhandi, Ahmad Sanmorino

Abstract: ***This study discusses the design of e-Notification architecture using short message service technology to improve community health center services. The e-Notification submitted can be used as a medium to deliver regular information such as vaccination schedules organized by the community health center, as well as a schedule of repeat visits for pregnant women. The use of e-Notification can reduce the time needed to broadcast information sent to the public simultaneously or personally. By using the proposed e-Notification architecture, large numbers of notifications can be sent simultaneously, with very high success rates. This proposed architecture can be used at Community Health Centers located in rural areas or areas far from urban areas. This architecture is still in the form of design, so it has not gone through a comprehensive testing phase. But from the brief comparison that we did to several other ways of delivering information, the architecture that we submitted requires a shorter time.***

Index Terms: Architecture, e-Notification, Short Message Service, Community Health Center.

I. INTRODUCTION

The Community Health Center (CHC) is a center for promoting healthy-minded development, empowering communities, families and first-level health services that are responsible for improving the quality of their services through providing relevant, fast and targeted information to patients, in an effort to achieve vision and their mission.

For this reason, this study focuses on increasing the percentage of CHC services to patients (especially pregnant women) through notification services related to pregnancy control schedules and family planning services, as well as reminder services for various types of immunizations that need to be given to pregnant women, infants/toddlers and children so that they can reduce infant/toddler mortality.

There are several previous studies related to improving services provided by community health centers, including those carried out by Kirby and Sharma [1] which discussed the level of service provided by CHC. Provide analysis and suggestions about what should be done to improve health services provided by CHC in each state. Setiawan et al. [2] in his paper also discussed the implementation of electronic medical records in data processing applications used in CHC. Research like this is very useful because it helps medical staff process medical record data so that it can be well structured, making it easier to conduct searches in a relative sort of time.

The use of information technology in community in various sectors provides a huge contribution in increasing income and keeping the economy spinning. The implementation of information technology in various business sectors has been carried out by several researchers [3]–[5]. The use of information technology in improving CHC services to the community has also been carried out since several years ago. Through this paper we try to contribute to improving CHC services to the community. The proposed contribution is the use of short message technology on cell phone (2G/GSM). The choice of SMS technology in 2G/GSM cell phone is because SMS technology uses the store and forward method, so that when the recipient/patient's cell phone is inaccessible or inactive or outside the service area, patients can still receive SMS when their cell phone is active back. The limitations of the use of smartphone technology with various features are things that must be considered when wanting to implement technology in disadvantaged communities, so the use of sophisticated smartphones to send notifications cannot be used in this case. In other words, a 2G/GSM based cell phone is the right choice because it is cheap and easy to use, so e-Notification services that use 2G/GSM mobile devices are expected to serve all levels of society.We have used smartphones to broadcast information in previous studies [6], because the target of e-Announcement services is students on campus so that the use of smartphone devices is the right choice. In different cases, smartphone devices can also be used for early warning about the arrival of disasters, so that people can avoid disasters and run to safer places [7], [8]. Another useful initiative for the use of smartphones is in the field of transportation, making it easier to provide information about bus departure and arrival schedules [9].

II. METHODOLOGY

The series of research stages that we will do can be seen in Fig. 1 of the following:

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***** Correspondence Author (s)
Rendra Gustriansyah, Faculty of Computer Science, Universitas Indo Global Mandiri, Palembang, Indonesia.
Nazori Suhandi, Faculty of Computer Science, Universitas Indo Global Mandiri, Palembang, Indonesia.
Ahmad Sanmorino, Faculty of Computer Science, Universitas Indo Global Mandiri, Palembang, Indonesia.

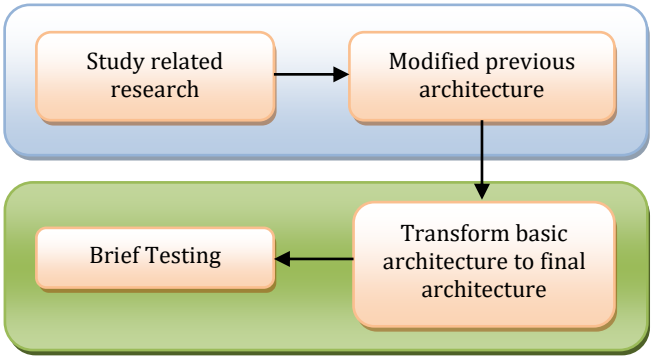

Fig. 1: The Steps to Design Proposed Architecture

The design of the e-Notification system architecture to broadcast information about health service schedules at CHC begins by looking at the e-Announcement architecture that was previously proposed in [6], as seen in Fig. 2. The next step is to match the architecture to the actual conditions in CHC, then adjust or decrease the version of some technological devices that will be included in the architecture.

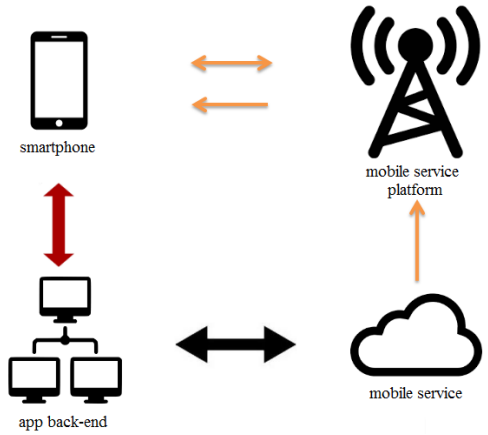

Fig. 2: The Architecture of e-Announcement Utilizing Smartphone [6]

The reason we explain the related research because the architecture to be proposed is a modification of the architecture that was made before [6]. In this case, we do not need to create architecture from the start, what must be done is only to replace some components of the architecture according to the requirements contained in CHC. There are several devices that will be adjusted or replaced, such as the use of mobile platforms, back-end applications, mobile services (cloud) and smart phones. This adjustment must be done so that the e-Notification service that utilizes cell phones (2G/GSM) can work optimally. So that the details of some elements of the architecture to be replaced are as follows:

Table I: The Replacement of Elements in Proposed Architecture

Previous Architecture	Proposed Architecture	Function
app back-end	Community Health Center Messaging Server	Make and send SMS
mobile service platform	GSM Provider	Spreading SMS messages to client
smartphone	cell phone (2G/GSM)	The device used to receive SMS

The results of the previous architecture modifications were in the form of a preliminary design or basic architecture that still had to be studied and evaluated. Therefore, based on the learning results, we carry out basic architecture transformed into a final architecture. Next is testing the architectural design that has been proposed [10]. But at the time this article was published, the research we conducted was only limited to making a test plan by looking at the tests carried out by third parties.

III. DISCUSSION

The initial design after adjustments can be seen in Fig.3.

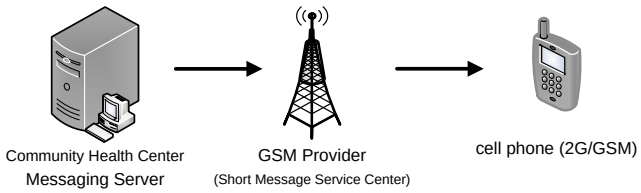

Fig. 3: CHC e-Notification Basic Architecture

For functions performed by the mobile platforms and the mobile services (cloud), it will be fully handed over to the short message service center (GSM provider) based on 2G/GSM technology. For the function of creating and sending short messages for notifications or reminders made by the back-end application will be lowered by using the SMS-Gateway Service that has the same function. This back-end application will send notifications relating to pregnant women or family planning services automatically in the form of SMS. This application will also provide a reminder to patients who need to get various types of immunizations, especially to pregnant women, infants/toddlers and children, so as to reduce the percentage of infant/toddler deaths that are still quite high. The last and foremost is the device that is on the side of the user or community, namely the 2G/GSM cellphone that can receive short message services (SMS). The obstacle that might arise is how to send a short message with the same content for many registered mobile devices. This e-Notification will broadcast a message simultaneously at the same time using the features available in the SMS-Gateway, by entering all cellphone numbers that have been registered in the mass mailing list.

So far, we have not experienced problems sending mass messages at once. The final design of the proposed CHC e-Notification system architecture is as shown in Fig. 4.

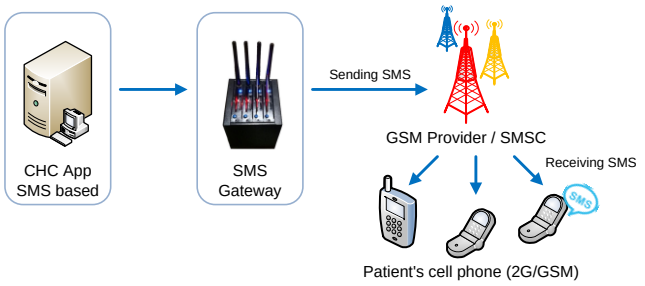

Fig. 4: The Final Architecture of CHC e-Notification

The final design of the proposed e-Notification architecture (Fig. 4) can be used as an alternative in notifying information about the CHC's service schedule to the patient. Patients can receive information on CHC service schedules in a sort of time, more efficient than conventional media such as bulletin boards or leaflets delivered door to door. One of the components of the proposed architecture is SMS-Gateway. Fig. 5 shows for example of the performance of the SMS gateway as a medium to broadcast messages. Testing carried out by third parties shows the performance rate that can be given by the SMS-Gateway. So in its implementation, CHC can use applications provided by third parties. This application is usually equipped with various features and interfaces that are very user-friendly. So for the testing plan, we will do enough to see the results of testing or application usage that has been done by the SMS-Gateway service provider.

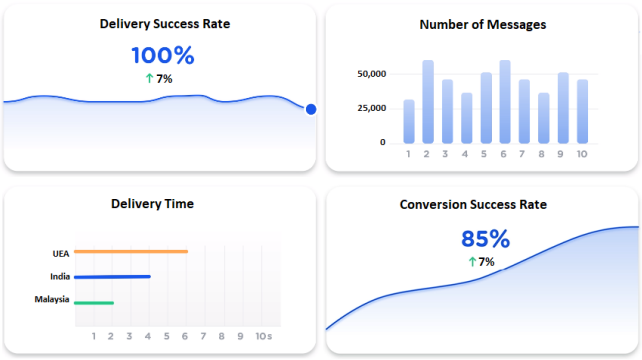

Fig. 5: Examples of Features Available on the SMS-Gateway

Through this monitoring window we can analyze the performance of the SMS-Gateway system, starting from the level of delivery in a certain period (per day, per week, etc.) to the features to immediately realize when there are obstacles in short message service traffic, speed and trend of sending SMS.

Other features related to SMS sending history such as seeing all messages that were successfully sent within a certain period of time, delete or classify old messages based on certain categories.

The success rate of sending short messages is greatly influenced by signal strength (dBm) and receiver quality found in cellphone service users. Fig. 5 shows that of the total 7% of messages sent, the success rate of delivery reaches 100%.

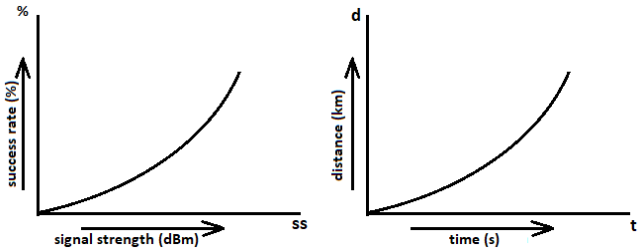

Fig. 6: Signal Strength-Success Rate and Distance-Time

Fig. 6 shows a comparison of GSM signal strength with the success rate of sending messages and shows a comparison of distances (d) with the time needed to send messages simultaneously. So for the delivery time (t) it really depends on the distance (d) between the SMS gateway server and the recipient who receives the short message service. The farther the distance between the two, the longer it takes to send a message. The brief comparison that has been done shows the performance that the proposed architecture can provide in conveying information from CHC to the client. If the client's residence is close to CHC where the SMS-Gateway server is located, of course, the use of the proposed architecture becomes very effective. But if the client's residence is very far away, it can become a problem. The solution, the client can move or become a user for other CHC closer to his home.

IV. CONCLUSION

The proposed e-Notification architecture can be a good choice for CHC in improving the quality of their services by providing relevant, fast and targeted information to patients/communities in the form of SMS.

This e-Notification can send notifications relating to pregnant women or family planning services automatically. In addition, e-Notification can also provide reminders to patients who need to get various types of immunizations, especially for pregnant women, infants/toddlers and children, so as to reduce the percentage of infant/toddler deaths.

The use of e-Notification can reduce the time needed to broadcast notifications sent simultaneously, but in implementing this e-Notification architecture it will depend on the real conditions in each CHC.

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REFERENCES

1. J. B. Kirby and R. Sharma, "The availability of community health center services and access to medical care," *Healthcare*, vol. 5, no. 4, 2017, pp. 174–182.

2. A. W. Setiawan, N. Utami, T. R. Mengko, and A. Indrayanto, "Implementation of electronic medical record in community health center towards medical big data analytics application," in *Proceedings of 2014 International Conference on Electrical Engineering and Computer Science, ICEECS 2014*, 2014, no. November, pp. 30–35.
3. R. Gustriansyah, D. I. Sensuse, and A. Ramadhan, "A sales prediction model adopted the recency-frequency-monetary concept," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 6, no. 3, pp. 711–720, 2017.
4. A. Sanmorino and Isabella, "The design a system of retention and control on broiler farms based on the flow of data," in *International Conference on Electrical Engineering, Computer Science and Informatics (EECSI)*, 2017, vol. 4, no. September, pp. 267–270.
5. R. Gustriansyah, N. Suhandi, and F. Antony, "The Design of UML-Based Sales Forecasting Application," *Int. J. Recent Technol. Eng.*, vol. 7, no. 6, 2019, pp. 1507–1511.
6. A. Sanmorino *et al.*, "E-announcement as an early warning notification using smartphone devices in a college," *J. Phys. Conf. Ser.*, vol. 1153, no. 1, 2019.
7. M. F. Sikder, S. Halder, T. Hasan, M. J. Uddin, and M. K. Baowaly, "Smart disaster notification system," in *4th International Conference on Advances in Electrical Engineering, ICAEE 2017*, 2018, vol. 2018–Janua, pp. 658–663.
8. M. Ghazal, S. Ali, M. Al Halabi, N. Ali, and Y. Al Khalil, "Smart mobile-based emergency management and notification system," in *Proceedings - 2016 4th International Conference on Future Internet of Things and Cloud Workshops, W-FiCloud 2016*, 2016, pp. 282–287.
9. M. Sneha *et al.*, "A mobile application for bus notification system," in *Proceedings of 2014 International Conference on Contemporary Computing and Informatics, IC3I 2014*, 2014, pp. 724–727.
10. H. Zhang and A. Rountev, "Analysis and testing of notifications in android wear applications," in *Proceedings - 2017 IEEE/ACM 39th International Conference on Software Engineering, ICSE 2017*, 2017, pp. 347–357.