
Telemedicine Development for Health Center Services Using Agile Methods

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ABSTRACT

Puskesmas are the spearhead of health services throughout Indonesia, puskesmas are at the forefront in breaking the chain of transmission of COVID-19 because they are located in every sub-district and have a regional concept. Being at the forefront in handling COVID19 and continuing to provide other primary health services to the community is a tough task for puskesmas throughout Indonesia. In urgent situations and rapidly changing regulations regarding the handling of COVID19 and non-COVID19 patients, telemedicine application development researchers are required to work quickly and precisely according to the needs of the Puskesmas. This study discusses the development of telemedicine applications using the Agile development method, with the Scrum framework. Based on the problems above, researchers will develop telemedicine applications with several health service features, namely; COVID19 independent health checks, village doctor and midwife consultations, medicine orders, maternity services, and dental consultation services, the features in the telemedicine application were developed using the agile scrum method. Telemedicine development begins with system design analysis, UI/UX design, develop, functional testing, usability testing and launching. From the system design analysis, it produces output use case diagrams and class diagrams, according to the needs of the puskesmas business process. UI/UX design is carried out using figma tools, then application development is carried out focusing on the frontend and backend, after the application has been developed, functional testing is carried out three times and usability testing. The results of the usability test conducted on 35 respondents obtained an average score through the SUS questionnaire with a score of 79. In terms of the Acceptability Range, this application program is in the Acceptable category, while on the Grade Scale it is in Grade C position and on the Adjective Rating it is in a Good position . The results show that the telemedicine application for Pusline is good and can be accepted by users.

Keywords: Telemedicine; Information Sistem, Agile, Agile Scrum, UsabilityTesting

1. INTRODUCTION

Indonesia has experienced a dark period in dealing with the COVID19 pandemic, which according to worldmeters peaked on July 15 2021. Based on existing studies, only 20% of infected patients require hospital care, while 80% are in self-quarantine and self-isolation at home, this is the task of the Puskesmas together with the cross-sectors involved as the District/Village/Kelurahan COVID-19 Task Force Team to carry out surveillance.

Puskesmas are the spearhead of health services throughout Indonesia, puskesmas are at the forefront in breaking the chain of transmission of COVID-19 because they are located in every sub-district and have a regional concept. Being at the forefront in handling COVID19 and continuing to provide other primary health services to the community is a tough task for puskesmas throughout Indonesia, including at the UPT Puskesmas Ngoresan Surakarta. According to drg. Retno Handarurini head of the UPT Ngoresan Health Center, currently at the Ngoresan Health Center serving the community in 36 RWs of Ngoresan District, with the help of 5 doctors and 30 health workers, the average number of patients seeking treatment at the Ngoresan Health Center is 100 patients.

In an urgent situation and regulations related to the handling of COVID19 and non-COVID19 patients are changing rapidly, telemedicine application development researchers are required to work quickly and precisely according to the needs of the Puskesmas. This study discusses the development of telemedicine applications using the Agile development method, with the Scrum framework. Agile was chosen because it is a software development

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method that is adaptive and responsive to change, such as the meaning of agile itself, which is agile (Syaiful, 2015). While the Scrum framework was chosen because it is a popular framework used for developing a system. About 65% of software projects have used Scrum (Jeldi, Krishna and Chavali, 2013). (Rizaldi, Dwi, & Hendra, 2016), Research on the Implementation of the SCRUM Methodology in Development of Electronic Payment Systems In Micro, Small and Medium Enterprises. results of the application of the SCRUM methodology to development research payment app with very small scale and team appropriate to be applied because it can anticipate changes that occur during the development process application.

Telehealth has been implemented in Australia to remote areas, one of the features in telemedicine is "exercise-based telemedicine" with the "Direct-contact Hub and Spoke" model for the treatment of chronic pain, and there are 21 chronic pain patients involved. (Purwaningsih, A, 2020). Results showed that 65% of participants reported improved functioning, 61% demonstrated improved mood, 57% reported increased physical activity, and 50% noted reduced pain levels. Overall the result of using telehealth is that over 90 people find telehealth convenient and will consider using it for their future health care.

New York University implemented expansion of telemedicine via video for mother-fetus during the covid pandemic. A total of 253 patients participated in 433 telemedicine visits, and 165 patients completed the survey. The response rate generated during the survey was 65%. Patients agree that telemedicine visits are as good as in-person visits (4 [3, 5] vs 3 [2, 3]; $P < .001$) and telehealth make it easier for them to see a doctor or specialist (5 [4, 5] vs. 3 [2, 3]; $P < .001$). Patients with obstetric history wanted remote treatment in the future compared to other types of visits (19 (90%) vs 2 (10%); $P = 0.05$). Response provider surveys also show high levels of satisfaction, with 83% agreeing that they would like telemedicine to be an option for future obstetric visits (Jessica, Samantha, 2021).

Based on the problems above, researchers will develop telemedicine applications with several health service features, namely; COVID19 independent health checks, doctor and village midwife consultations, medicine orders, maternity services, and dental consultation services, the features in the telemedicine application were developed using the agile scrum method, it is hoped that by using agile scrum the telemedicine application development can run successfully and accommodate user needs from the health center.

2. LITERATURE REVIEW

Metode Agile

Agile is a group of iterative and incremental software development methods. The Agile model includes a series of methods consisting of Scrum, Crystal Clear, Extreme Programming (XP), Adaptive Software Development (ASD), Feature Driven Development (FDD), and Crystal Dynamic Systems Development (DSDM) Methods, Lean Software Development and others. (Khumar & Bhatia, 2012). (Sommerville, 2011) Put forward the Agile method is an incremental development method that focuses on rapid development, software released in stages, reducing process overhead, and producing high quality code and in the development process involving customers directly. This model is a development of the framework Agile whose main goal is to accelerate the process of implementation and delivery on management information systems (Alqudah & Razali, 2016).

(Ian, 2011) Stated that the agile method is an incremental development method that focuses on rapid development, software released in stages, reducing process overhead, and producing high-quality code and in the development process involving customers directly.

Model Scrum

Scrum was first introduced by Jeff Sutherland in the early 1990s and developed later by Schwaber and Beedle. Scrum outlines the process for identifying and cataloging the work that needs to be done, priority on those who work by communicating to customers and release them online iterative (Andriati & Widyadi, 2015). The Scrum model is an iterative approach to development of software that carries agile principles (Hadinata, Novri, & Muhammad, 2017). in the Scrum Model users are actively involved in the system development process information, so that in real terms the resulting information system can meet the needs user (Usman, 2018). Scrum becomes an Agile model that is easy to implement and which allows the development of systems or applications in an effective, practical, and short time (Srivastava & Jain, 2017).

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Puskesmas

Puskesmas is a health facility that organizes community health efforts and individual health efforts at the first level, by prioritizing promotive and preventive efforts, to achieve the highest degree of public health in its working area. Thus, to support the functions and objectives of the Puskesmas, health human resources, both health workers and health support staff, are needed (Direktorat Pelayanan Kesehatan Premier, 2020).

The Role of Community Health Centers in Handling COVID19

The role of the Puskesmas is very important in realizing community independence through community empowerment in changing behavior and the environment which is in line with H.L Blum's theory, namely that people are encouraged to have healthy living behaviors that have awareness, willingness and ability to live healthy and live in a healthy environment. Based on existing studies, only 20% of infected patients require hospital care, while 80% are self-quarantined and self-isolated at home, which is the task of the Puskesmas together with cross-sectors involved as the District/Village/Kelurahan COVID-19 Task Force Team. to carry out supervision (Direktorat Pelayanan Kesehatan Premier, 2020)

Telemedicine

In general, telemedicine is the use of information and communication technology combined with medical expertise to provide health services, ranging from consultations, diagnoses and medical procedures, without being limited by space or carried out remotely. The same opinion was also expressed by Soegijardjo Soegijoko, that telemedicine or telemedicine is the use of information and communication technology including electronics, telecommunications, computers, informatics to transfer (send and/or receive) medical information, to improve clinical services (diagnosis and therapy) and education. The word "tele" in Greek means: far, at a distance, so that telemedicine can be interpreted as medical services, even though they are separated by distance. (WHO,1998)

3. METHOD

This research develops telemedicine to assist puskesmas services during and after the COVID19 pandemic, the development of telemedicine uses the Agile Scrum method. The stages of telemedicine development using the agile scrum method are presented in Figure 1.

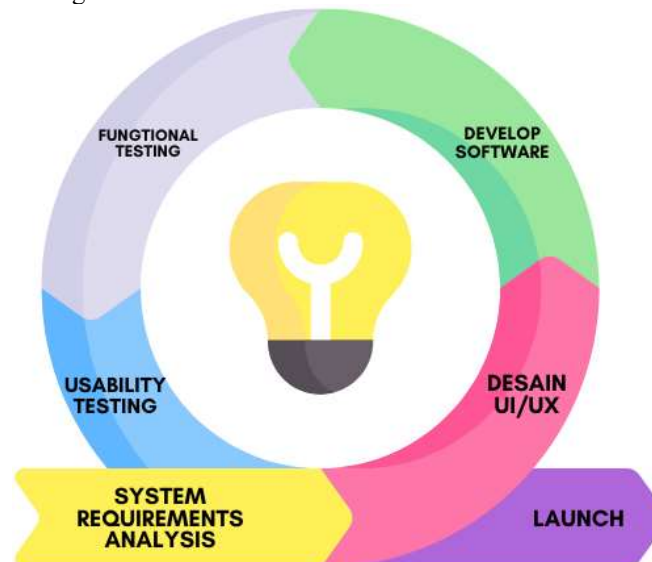


Figure 1. Framework Agile Scrum

The research activity began with brainstorming in a discussion group forum with users from the Public Health Center. This activity is carried out to explore the needs of partners and then analyze the needs of the system. The output generated from this system design analyst is the compilation of BRD documents which contain Entity Relationship

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diagrams and use case diagrams. At this stage we divided the scale of development priorities into the most needed services, the result is that the Covid19 service is considered an urgent service feature to be developed first.

After the system requirements have been identified, the next stage is the UI/UX mockup design using figma. The designs made in figma are the display of COVID-19 independent health checks, consultations with doctors and village midwives, ordering medicines, services for pregnant women, and dental consultation services.

The stages after UI/UX design are application development from the frontend side using php and reactJS languages and the backend using the CI framework. After application development is application testing and quality assurance, this stage is carried out to find out whether the application functionality is running well, then checks for system errors and bugs if there are still system errors then improvements will be made again, this stage puts forward stringent testing of telemedicine applications that was built, before the application was used by puskesmas users. The second test is usability testing, this test is carried out to determine the level of user satisfaction after using the telemedicine application.

The test results will determine the next stage whether the system being developed has improvements or is already running well, if there are findings of errors or errors then a design analysis, UI/UX design and application development will be carried out again, but if an error has been found then the application is ready to be launched to puskesmas users.

4. RESULT

Information system requirements analysis was obtained from brainstorming activities in FGDs with Puskesmas users. This activity is carried out to explore the needs of partners and then analyze the needs of the system. The results of the FGD showed that in telemedicine applications there are 4 actors with different access rights, namely patients, doctors, midwives and small and medium enterprises.

Hask access for each actor involved in using the system is presented in table 1.

Aktor	Keterangan
Pasien	Patients are users who will use the telemedicine application to seek treatment at the puskesmas in each area according to the patient's medical record number.
Dokter	Is a doctor on duty at every health center in the dental, KIA, Nutrition.
Bidan	Midwives are health workers who accompany patients in the maternal and child health polyclinics.
UMKM	Is a user of healthy food sellers who will sell healthy food in addition to nutritional intake according to doctor's recommendations.

Telemedicine applications also have 15 functional requirements. The following is the use case diagram of the results of the brainstorming analysis of the system requirements presented in Figure 2.

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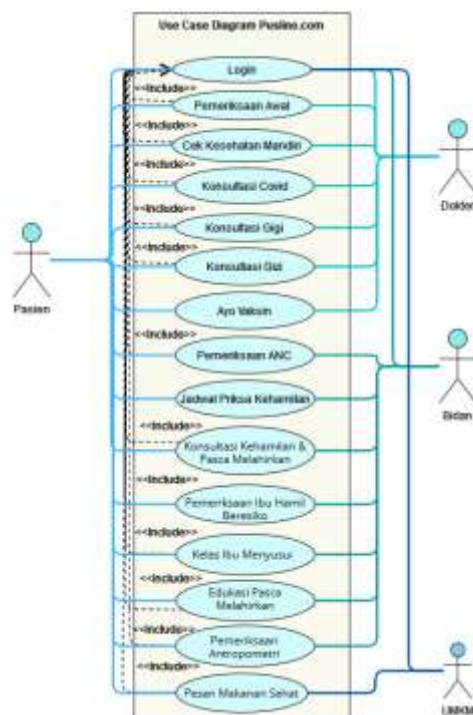


Figure 2. Usecase Diagram Telemedicine

The next system design analyst documentation was successful in identifying a class diagram that describes the structure of a telemedicine application consisting of classes that have attributes and methods or operations. In pusline.com there are 29 classes that detail the relationship between classes and their respective functionalities.

The telemedicine application interface design was developed using figma, the following shows the system interface design using figma. The result of the interface design is the telemedicine application mockup design. UI/UX design is important before telemedicine applications are developed from the frontend side.

Telemedicine application development is developed using progressive web apps architecture. Development begins with creating program code on the frontend, in this section using the PHP programming language, while the backend uses JavaScript. In the database using MYSQL. At this stage what is being developed are COVID19 services, maternal and child health services, dentist services, nutrition services and let's vaccine services. The resulting telemedicine application can be used and run on Android, IOS mobile devices like a mobile application and can also be installed on a desktop and can be run in a web browser. The results of application development in figure 5.

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Figure 5. Page Home Telemedicine

In the functional testing stage, it was carried out in three stages, in the first and second stages, system errors were still found, while in the third test, the results of the test showed that all functional features on the telemedicine application menu had worked properly without any errors and bugs. Usability testing uses the System Usability Scale (SUS) instrument which can test the Learnability, Efficiency and Satisfaction of the Pusline telemedicine application. Respondents involved in this testing were 35 respondents consisting of midwifery and informatics.

5. DISCUSSIONS

Usability testing results using the SUS System Usability Scale instrument are reliable, popular and effective Usability scales. The System Usability Scale (SUS) can test (1) Learnability, in simple terms it can be said that the system must be easy to learn so that users can quickly start completing work using the system; (2) Efficiency, the system should be used efficiently so that users who have studied the system can achieve a high level of productivity; and (3) Satisfaction,

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a comfortable system to use so that it satisfies the wearer. The following is a scenario in the SUS instrument presented in Figure 7.

No.	Role Peran	Skenario Pengujian
LAYANAN COVID		
1.	Pasien covid	<ul style="list-style-type: none"> ◆ Silahkan mengakses aplikasi telemedicine pada link berikut https://pusline.com/ ◆ Silahkan mendaftar menggunakan akun gmail ◆ Silahkan login ke aplikasi telemedicine menggunakan akun gmail ◆ Silahkan memasukkan data pemeriksaan awal ◆ Silahkan melakukan cek kesehatan mandiri ◆ Silahkan melakukan konsultasi dengan dokter melalui chat dokter covid (pesan teks, gambar dan suara) ◆ Silahkan membaca berita seputar covid ◆ Silahkan mencari informasi seputar covid melalui QnA ◆ Silahkan masuk pada halaman dashboard ◆ Silahkan melihat history hasil cek kesehatan mandiri
LAYANAN KESEHATAN UMUM		
2.	Poli Ibu Dan Anak Pasien Ibu pasca melahirkan	<ul style="list-style-type: none"> ◆ Silahkan login ke aplikasi telemedicine menggunakan akun gmail ◆ Silahkan masuk ke menu Poli Kesehatan Ibu dan Anak ◆ Silahkan melihat hasil pemeriksaan ANC ◆ Silahkan melihat jadwal pemeriksaan kehamilan ◆ Silahkan konsultasi dengan bidan terkait ketumuhan ◆ Silahkan membaca artikel tentang kehamilan
4.	Poli Gigi	<ul style="list-style-type: none"> ◆ Silahkan login ke aplikasi telemedicine ◆ Silahkan masuk ke menu Poli Gigi ◆ Silahkan konsultasi dengan ahli gigi terkait permasalahan gigi ◆ Silahkan mempelajari materi di artikel pasca melahirkan ◆ Silahkan keluar dari aplikasi
5.	Vaksin	<ul style="list-style-type: none"> ◆ Silahkan login ke aplikasi telemedicine ◆ Silahkan melihat jadwal pelaksanaan vaksinasi ◆ Silahkan mempelajari materi di artikel pasca melahirkan ◆ Silahkan keluar dari aplikasi
4.	Pesan Makanan Sehat	<ul style="list-style-type: none"> ◆ Silahkan pesan makanan sehat dengan masuk ke menu Makanan Sehat ◆ Silahkan melihat detail masing-masing menu yang akan di pesan ◆ Silahkan menambahkan menu kedalam keranjang belanja sesuai jumlah yang akan di pesan ◆ Tambahkan catatan pada pesanan menu ◆ Silahkan cek alamat pengiriman jika masih kosong silahkan di isi sesuai dengan alamat tujuan pengiriman ◆ Silahkan di pesan ◆ Silahkan cek pesanan anda ◆ Silahkan hubungi penjual untuk konfirmasi lebih lanjut

Figure 7. Skenario Pengujian Usability

Respondents who were involved in usability testing at pusline.com were 35 respondents, these respondents were users who first used pusline telemedicine. Data collection was carried out for 7 days by taking respondents randomly. After collecting data from respondents, then the data is calculated. In how to use the System Usability Scale (SUS) there are several rules in calculating the SUS score. The following are the rules for calculating scores on the questionnaire:

1. For each odd numbered question, the score for each question obtained from the user's score will be reduced.
2. For each even numbered question, the final score is obtained from the value of 5 minus the question score obtained from the user.
3. The SUS score is obtained from the sum of the scores for each question which is then multiplied by 2.5

The score calculation rules apply to 1 respondent. For further calculations, the SUS score of each respondent is sought by the average score by adding up all scores and dividing by the number of respondents. The following formula calculates the sus score:

$$x = \frac{\sum x}{n}$$

x = Skor Rata-Rata
 x = Jumlah Skor SUS
 n = Jumlah Responden

The following is the result of calculating the score from the respondents' answers:

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Table 2. Result Usability Testing

No. Responden	Skor Tiap Butir										Jumlah Skor	Skor Akhir
	1	2	3	4	5	6	7	8	9	10		
1	3	2	3	3	3	3	3	3	3	1	27	67,5
2	4	3	3	3	3	4	3	4	4	2	33	82,5
3	4	4	4	2	4	4	4	4	4	2	36	90
4	4	4	4	0	4	4	4	4	4	4	36	90
5	4	4	4	4	4	4	4	4	4	4	40	100
6	3	3	3	2	3	3	3	3	3	1	27	67,5
7	3	3	4	1	4	3	4	3	4	3	32	80
8	4	3	4	3	4	4	4	4	4	3	37	92,5
9	4	4	4	4	4	4	3	4	3	4	38	95
10	4	4	4	3	4	4	4	4	4	3	38	95
11	3	3	3	4	4	3	4	3	3	1	31	77,5
12	4	3	4	2	3	3	4	4	4	3	34	85
13	4	4	4	3	4	4	4	4	4	1	36	90
14	4	2	3	2	4	3	3	3	1	1	26	65
15	4	4	4	4	4	4	4	4	4	4	40	100
16	4	4	4	3	4	4	4	4	4	4	39	97,5
17	4	4	4	3	4	4	4	4	3	3	37	92,5
18	3	2	3	4	2	3	3	4	4	1	29	72,5
19	3	3	3	3	3	3	3	3	3	3	30	75
20	4	0	4	0	4	0	4	0	4	0	20	50
21	4	3	4	3	4	3	4	3	4	3	35	87,5
22	3	2	3	2	3	2	3	2	3	1	24	60
23	2	4	3	3	3	3	3	3	3	3	30	75
24	3	3	3	3	3	3	3	3	3	2	29	72,5
25	4	4	3	4	4	3	3	4	4	4	37	92,5
26	4	4	4	4	4	4	4	4	4	4	40	100
27	4	4	4	4	4	4	4	4	4	4	40	100
28	3	3	4	4	3	4	3	4	4	1	33	82,5
29	3	2	2	1	3	2	2	2	3	1	21	52,5
30	2	2	3	3	2	2	3	2	1	1	21	52,5
31	4	3	3	4	3	3	3	4	3	3	33	82,5
32	3	3	3	2	1	4	1	1	1	0	19	47,5
33	3	3	3	1	3	2	3	3	3	1	25	62,5
34	3	3	3	2	1	1	2	3	1	1	20	50
35	4	3	3	4	3	3	3	4	3	3	33	82,5

From the results of research conducted on 35 respondents, the average score results obtained through the SUS questionnaire with a score of 79

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CONCLUSION

The results of the research show that the Agile Scrum framework can work well and can be used as a reference for application developers to determine each stage of development. The results of application testing using usability testing conducted on 35 respondents can be obtained with an average score through the SUS questionnaire with a score of 79. In terms of the Acceptability Range, this application program is in the Acceptable category, while on the Grade Scale it is in Grade C and on the Adjective Rating is in a good position. From these results it can be concluded that the telemedicine Pusline application is good and acceptable to users.

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