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Rice Planting Calendar Application Development using Scrum

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Abstrak

Indonesia merupakan negara agraris yang menghasilkan komoditas padi lebih banyak dibandingkan tanaman palawija. Banyak masyarakat yang berprofesi sebagai petani memilih lahan untuk menanam padi. Petani mengalami beberapa kendala dalam menentukan waktu tanam yang tepat untuk meningkatkan kualitas panen padi. Kalender tanam merupakan metode yang digunakan petani untuk menentukan jadwal tanam selama satu tahun. Kalender tanam padi bekerja berdasarkan pola curah hujan dan iklim. Dengan bantuan teknologi terkini, penentuan kalender tanam padi dapat dilakukan dengan cepat. Pemanfaatan teknologi komputer dan algoritma seperti Jaringan Syaraf Tiruan sangat membantu untuk meramalkan curah hujan menggunakan data runtun waktu secara akurat pada bulan berikutnya. Kalender tanam terhubung dengan data dari Badan Meteorologi, Klimatologi, dan Geofisika (BMKG) dari setiap stasiun di setiap wilayah. Kalender tanam padi dibuat berbasis mobile bertujuan untuk memberikan kemudahan bagi pengguna dalam genggaman. Aplikasi kalender tanam ini dikembangkan dengan menggunakan metode Scrum. Tahapan pengembangan aplikasi terdiri dari sprint planning, sprint pertama, sprint kedua, sprint ketiga dan usability testing. Hasil pengembangan sprint berjalan dengan baik. Setelah cerita selesai, dilanjutkan dengan tahap usability testing menggunakan System Usability Scale (SUS). Uji SUS diberikan kepada 20 responden yang memiliki kriteria termasuk petani dan pemilik lahan. Hasil SUS pada aplikasi kalender tanam padi mendapat skor 72,75 dengan kategori Baik.

***Kata kunci**—BMKG, kalender tanam, Metode Sprint, padi, System Usability Scale (SUS)*

Abstract

Indonesia is an agricultural country that produces more rice commodities than secondary crops. Many people who work as farmers choose the land to plant rice. Farmers experience several obstacles in determining the correct planting time to improve the rice harvest quality. A planting calendar is a method used by farmers to determine the scheduling of planting for one year. The rice planting calendar works based on rainfall and climate patterns. With the help of the latest technology, determining the rice planting calendar can be done quickly. The utilization of computer technology and algorithms such as Artificial Neural Network is helpful for forecasting rainfall using time series data accurately in the following month. The planting calendar is connected to data from the Meteorology, Climatology and Geophysics Agency (BMKG) from each station in each region. The rice planting calendar is made on a mobile basis with the aim of providing convenience for users in their hands. This cropping calendar application was developed using the Scrum method. The application development stages consist of sprint planning, first sprint, second sprint, third sprint and

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usability testing. The results of the development of the sprint went well. After completing the story, it was continued with the usability testing stage using the System Usability Scale (SUS). The SUS test was given to 20 respondents who had criteria including farmers and landowners. The results of SUS on the rice planting calendar application got a score of 72.75, which was categorized as Good.

Keywords*—BMKG, planting calender, sprint method, rice, System Usability Scale (SUS)*

1. INTRODUCTION

Indonesia is an agricultural country where most of the population works as farmers. This is also supported by the vast farmland and natural resources that are diverse and abundant [1]. Rice commodities have the largest land area compared to secondary crops [2]. This fact is supported by the fact that many people have more land to plant rice crops. The planting calendar is used by farmers, including rice farmers using it to schedule planting for one year. The rice planting calendar works based on rainfall and climate patterns [3], so the data used to determine the rice planting calendar can be taken from several statistical data centres in Indonesia.

With the help of the latest technology, determining the rice planting calendar can be done quickly. The utilization of computer technology and algorithms such as Artificial Neural Network is helpful for forecasting rainfall using time series data accurately in the following month [4]. In Indonesia, the Meteorology, Climatology and Geophysics Agency (BMKG) has many geophysical stations spread across various regions. BMKG has rainfall forecast data that parties in need can use. It is possible to process the data into a rain planting calendar for easy use by farmers with the rainfall forecast data. The Indonesian Agricultural Research and Development Agency already has an integrated planting calendar information system that can be accessed via the internet [5]. The planting calendar is connected to BMKG data from each station in each region.

Mobile applications are a new trend in recent decades, and various web applications have their versions of mobile applications with the aim of ease of use in the hand. Mobile applications for agriculture are very suitable for field conditions, making it easier for users to use them anytime [6]. The use of mobile applications as agricultural information dissemination is very supportive because, on the one hand, all social media are connected so that the data exchange process is also very easy for farmers [7]. Scrum is a framework used to develop and manage complex products [8]. Scrum has a better ability than waterfall in terms of project success, time, and cost [9].

Application development will be carried out using data from the BMKG for rainfall data collection, which can then be used as supporting media for determining the rice planting calendar. The application is developed based on the needs of farmers and the community according to the results of a survey conducted on 30 respondents with the result they want the application to be developed in the mobile application form. The application features will provide the data needed by the user, but it is also necessary to test whether the usability of this application will provide user comfort during the use of the application. The key to the success of digital applications is the level of usability [10], so this is an important part to do. Usability testing needs to be done on the application prototype so that when the development is at an advanced stage, there are no fatal errors [11].

Usability measurement can be done using the Computer System Usability Questionnaire (CSUQ) [12], System Usability Scale (SUS) [12][13][14][15] instrument, Usability Metric for User Experience (UMUX)[12][15], Single Ease Question (SEQ)[16], Questionnaire for User Interface Satisfaction (QUIS)[16], and Retrospective Think Aloud (RTA)[16]. All these methods have standard tested questions to measure usability. SUS is an evaluation instrument that contains ten questions by showing the level of approval of each question with a Likert scale

ranging from 1 to 5. SUS can measure several characteristics of an application, namely Easy to learn, Inconsistencies, Easy to memorize and Satisfaction [13].

In most of their studies evaluating usability measurements at the prototype stage, research conducted in research [14] conducted usability testing on mobile applications for the health sector with 55 veteran respondents who had various characteristics from age, gender, skin colour, education, marital status, income, and the degree of propensity to alcoholism. Measurements were carried out for six months with a SUS value of 69.3 (SD 19.7) for the 1st month and 71.9 (SD 15.8) for the third month. Evaluation of usability measurements was also carried out in research [15] using the SUS and UMUX-LITE instruments with the object of massive online application. Web-based open course, the purpose of this study is to identify user interface problems that occur in Coursera and open education. The results of this study show that Coursera and open education have a high gap on UMUX-LITE and a low gap on SUS. Research conducted in [16] used the Single Ease Question (SEQ), System Usability Scale (SUS), Questionnaire for User Interface Satisfaction (QUIS), and Retrospective Think Aloud (RTA) instruments to test the usability of a mobile-based zakat application prototype. The results in this study usability obtained is very low, so it needs to be redesigned from the side of the user interface.

Based on the explanation in the paragraph above, the purpose of this research is to develop an application using the Scrum framework and perform usability testing using the SUS questionnaire instrument on a mobile-based rice planting calendar application. The Scrum framework aims to deliver products of the highest possible value and quality. The iterative and incremental nature of Scrum is so that products can continue to be competitive and increase the value of their products based on needs. After getting the usability value, it is hoped that the development of the rice planting calendar application at a later stage can improve the quality of the user experience from the UI/UX side. The quality of the user experience in terms of UI/UX is carried out by usability to ensure that the products made have been designed correctly and have met the needs of the planting calendar application.

2. METHODS

This research has stage from determining user needs, application development to application testing.

2.1 Determination of Application Requirements

Based on a survey that has been conducted to 20 respondents, it was found that the application feature needs, this is what will be appointed as the product goal in this study. Table 1 is a user story or a list of user needs. Based on this table, the product goal in this study is also set, namely "Making it easier for people to plant rice".

Table 1 User Story

No	User Story
1	As a farmer, I want to get weather data easily so that rain predictions can be obtained quickly
2	As a farmer, I want to know the monthly rainfall data on one platform so that I can easily access the data
3	As a farmer, I want to get detailed information related to the agricultural sector so that I don't misunderstand the terms

2. 2 Product Backlog

The product backlog is a collection of lists compiled based on user stories. The scrum team will use the product backlog as the basis for the work to be done during the application development process. Table 2 presents a list of product backlogs along with user point and priority data.

Table 2 Product Backlog

Story	Product Backlog	Story Point	Priority
1	Calling API from BMKG	6	1
	Homepage design to display weather and rainfall data	4	2
	Display current weather on the dashboard widget	10	3
2	Showing rainfall in a list	10	4
	Displays rainfall in a list	8	5
3	Agricultural terms and information page design	4	6
	Displays a list of agricultural information and terms	6	7
	Searching for foreign information and terms using keywords	8	8

2. 3 Scrum

In this section, an application development activity will be carried out to produce work and value. This stage is carried out transparently to the entire team. As shown in Figure 1 is the flow of scrum. Sprint planning will be carried out before the sprint process is carried out. The sprint process includes several activities, including daily sprints, sprint reviews and retrospective sprints. Sprint will stop iterating when the definition of done is found.

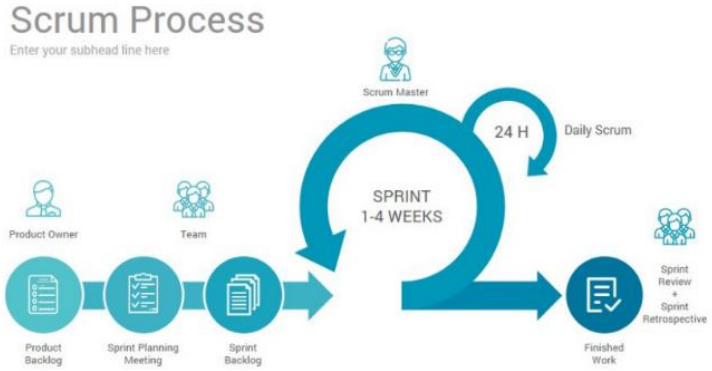

Figure 1 Flow Scrum

2. 4 Application Testing

One of the usability tests that is often used and the most popular is SUS, developed by John Brooke, which has reliable, popular, effective, inexpensive and can be used in a global assessment of the usability of cropping calendar applications. SUS consists of ten question components and five answers ranging from strongly disagree to agree strongly and have a minimum score of 0 and a maximum of 100. The question component of the SUS that will be used refers to Brooke's instrument [17][18]. The components of the SUS question can be seen in Table 3.

Table 3 Components of the Indonesian Version of the SUS Question

No	**Components**
1	I think I will use this system again.
2	I find this system complicated to use.
3	I find this system easy to use.
4	I need help from someone else or a technician in using this system.
5	I feel the features of this system are working properly.
6	I feel there are a lot of things that are inconsistent (incompatible on this system).
7	I feel like other people will understand how to use this system quickly.
8	I find this system confusing.
9	I feel there are no obstacles in using this system.
10	I need to get used to it first before using this system.

In Table 4, below are the SUS scores [19], [20]. The results can be a processing of the SUS question components from the respondents to get the average value of the SUS score. So from the resulting score, it can see that the proposed design is correct, efficient, and effective and follows the application's needs.

Table 4 SUS Score

Range	Letter Value	Status
>81	A	Excellent
68-81	B	Good
68	C	OK/Fair
51-67	D	Poor
<51	F	Worst

Testing the prototype of the intelligent digital signature application was carried out using SUS given to twenty respondents. Determination of the number of respondents based on previous research, with twenty respondents, the problems tested approached the level of certainty of 95% [18] or a minimum sample size of 12-14 respondents for fairly reliable results [21]. Respondents in this study amounted to twenty users who were divided into two groups, namely ten adult female respondents and ten adult male respondents. Data collection was carried out using a random sampling technique [22].

3. RESULTS AND DISCUSSION

The scrum stages are carried out according to Figure 1. The product backlog that has been compiled in Table 2 is then processed at the next stage.

3. 1 Sprint Planning

Sprint planning has been implemented with the results as shown in Table 5.

Table 5 Sprint Planning Results

Activity	Story Point
Sprint 1	**20**
Design API	6
Home UI Design	4
Create Mockup	1
UI Implementation	3
Parsing Wheather data to home	10
Weather Data Previous 3 Days	4
Weather Data According to Filter	6
Sprint 2	**18**
Parsing Rainfall Data to Home	
List of 12 Months Rainfall Data	10
Monthly Rainfall Details	8
Sprint 3	**18**
Information UI Design	4
Mockup Creation	1
UI Implementation	3
Information Data List	6
Information Search Features	8

Table 5 explains that the sprint will be carried out 3 times in accordance with the order of priority in Table 2.

3. 2 Sprint 1

The sprint stage 1 was successfully implemented with a duration of 2 weeks, the results of making the mockup can be seen in Figure 2 and the results of the mockup implementation can be seen in Figure 3.

Figure 2 Home UI Design

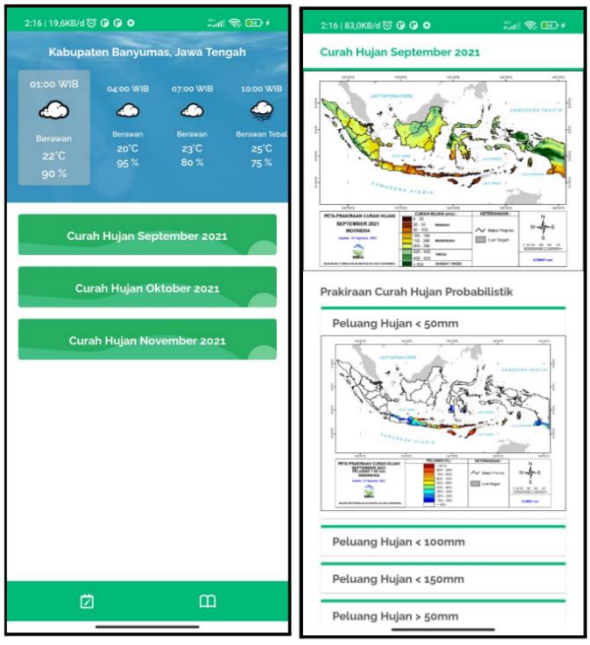

Figure 3 Home UI Implementation

As seen in the burndown chart Figure 4, completed the API design task and the home UI design task were less than the ideal target, but the difficulty experienced by the team was in the weather data parsing task. This difficulty causes some points to exceed the perfect target. The results of the sprint review found that the API documentation from the data centre is incomplete, so it takes more time to study the available endpoints. The results of the retrospective sprint show that communication between members is good enough and should be maintained in the next sprint.

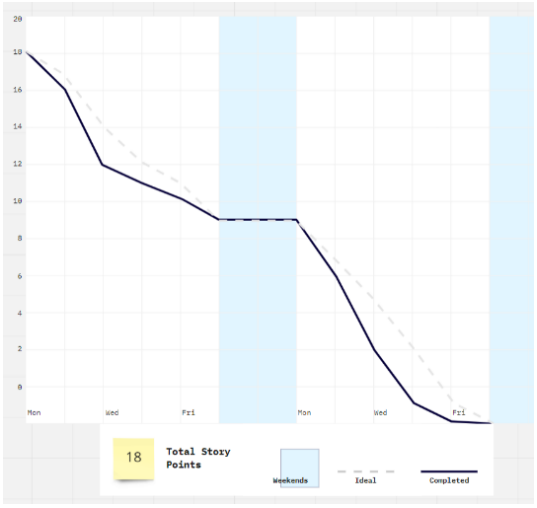

Figure 4 Burndown Chart Sprint 1

3. 3 Sprint 2

At this stage, sprint 2 went well according to the ideal line that had been determined. This condition was influenced by the sprint retrospective carried out in the previous step. The sprint retrospective is the section used to evaluate errors that occurred during the sprint stage so that these errors do not happen again [23]. That is caused sprint 2 to run well. Figure 5 is a burndown chart of sprint 2. Sprint 2 in the first week went well. It can be seen from the completed line that it was below the ideal line, while in the second week, it was running with several obstacles such as displaying rainfall details, rainfall details obtained in the form of images so that new adjustments were needed. Those are outside of sprint planning.

Figure 5 Burndown Chart Sprint 2

3. 4 Sprint 3

This stage is the final stage of application development following the sprint planning designed in Table 5. This stage was also completed. Sprint 3 had difficulties in several similar backlogs as in sprint 1 and sprint 2, namely making mockups of information pages with results like in Figure 6, implementing the mockup to the UI with results as in Figure 7, displaying a list of information and information search features. All activities in sprint 3 are depicted on the burndown chart of sprint 3 as shown in Figure 8.

Figure 6 Information Page UI Design

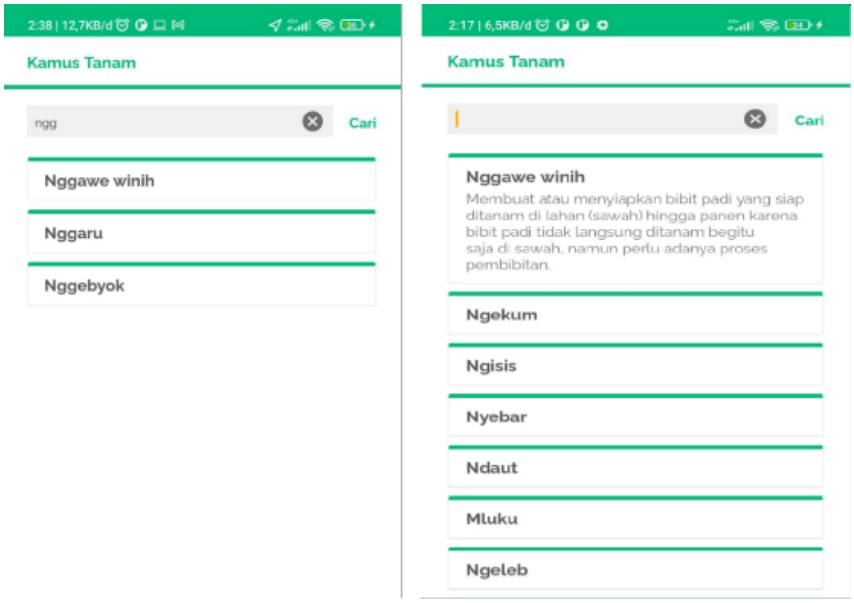

Figure 7 Information Page UI Implementation

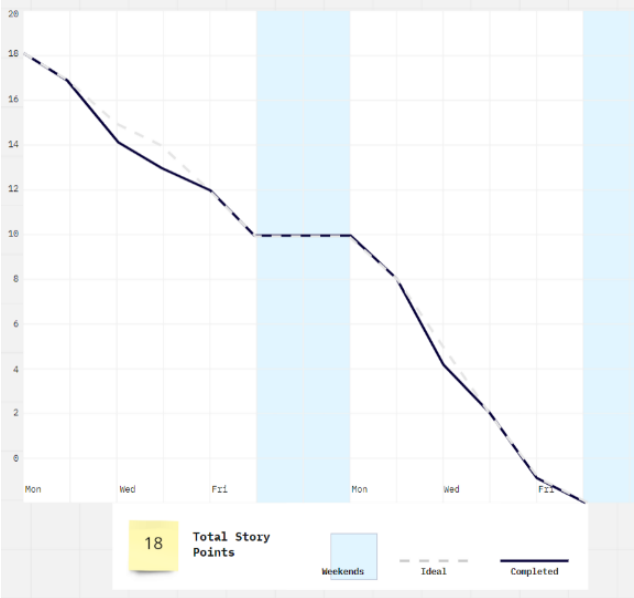

Figure 8 Burndown Chart Sprint 3

3. 5 Usability Testing

At the design stage, this design then goes through the testing stage. The design testing of the cropping calendar application using SUS. From the data obtained from the SUS questionnaire with 20 respondents. The criteria for these respondents are farmers and plantation landowners aged 35-50 years; then, calculations are carried out according to the procedures in SUS data analysis. The data from the SUS calculation are shown in Table 6.

Table 6 SUS calculation result data

Respondent	total	SUS Score
R1	29	72,5
R2	30	75
R3	25	62,5
R4	26	65
R5	22	55
R6	30	75
R7	29	72,5
R8	28	70
R9	28	70
R10	29	72,5
R11	32	80
R12	30	75
R13	29	72,5
R14	33	82,5
R15	32	80
R16	30	75
R17	28	70
R18	31	77,5
R19	28	70
R20	33	82,5
Average		72,75

From Table 6, it can be seen that the average score obtained is 72.75. This score is a good score on the SUS test. So it can be said that the design of this planting calendar application has been designed correctly and effectively and is ready to be implemented into an actual application. It can be seen that the results of the SUS score from the prototype design of the planting calendar application are above the average. This application prototype, this application prototype UI design SUS score result was rated in the "Good" category, as shown in Figure 9.

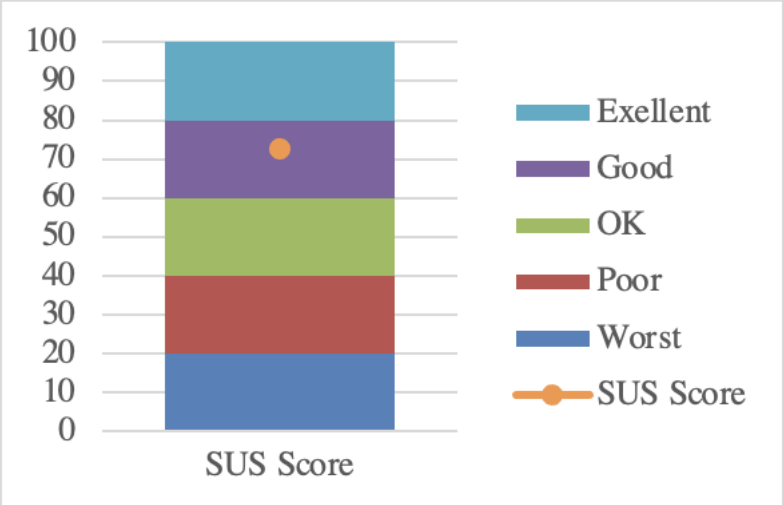

Figure 9 SUS Test Result

The Cropping Calendar application development process is completed according to the target level of success and the time specified. Based on the burndown chart in Figure 4, there were no obstacles experienced by the team, the target for completing the sprint backlog was running above the ideal target. It means that there were no severe obstacles in the sprint 1 stage; several things were carried out in retrospective sprints, including to ensure that the next sprint also did not encounter problems. The burndown chart in Figure 5 shows that the sprint backlog can be completed well, but in the second week, the completed line is above the ideal line, which shows that there are obstacles that cause the line not to match the ideal line. Based on retrospective results, it was found that the problem was the difficulty in displaying rainfall data. Based on the burndown chart in Figure 8, there is no complete line above the ideal line; this shows that the backlog is completed without any problems causing additional time. Judging from the overall burndown chart, it shows that all sprints went well. It can be stated that the application was successfully developed according to the target, time and available resources. In the testing phase, questions related to SUS were asked to 20 respondents. The respondent's criteria are a farmer and landowner. Based on SUS's usability testing results, it gets a value of 72.75, which indicates a "Good" value.

4. CONCLUSIONS

The planting calendar application is developed to determine the best time to plant rice, and a planting dictionary is available; farmers need that. This application aims to increase the amount of rice harvest based on the right time for planting crops. The design stage is done by determining the sprint of 3 sprints, mockup design, to the testing stage. That design stage is then tested to ensure that the design that has been made has been designed correctly and is following the needs of the planting calendar application. From the test results obtained, an average score of 72.75 indicates a "good" value.

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