Development of a Dental Practice Medical Record Using The Scrum Methodology

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Abstract Dental practices in Jimbaran area currently record medical records manually. This leads to potential data inaccuracies, longer wait times for patients, and difficulties in tracking patients' medical histories. An information system for dental practice medical records was designed to address these issues. The development method employed in this study is the Scrum methodology. The advantage of the Scrum method is that it ensures the final product meets user needs by actively involving users in the information system development process. The findings of this research have been developed into a Dental Practice Medical Records Information System to assist dental practices in recording their medical records.

Keywords: Dental Practice, Information System, Scrum

I. INTRODUCTION

In this modern era, technology has developed rapidly. The proper use of technological advancements can simplify human tasks. For example, without technology, a clinic must conduct a manual search to find patient medical records. However, with an information system, manual searches are no longer necessary. All healthcare facilities, including private practices and dental clinics, must implement electronic medical records starting January 1, 2024, in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 24 of 2022 [1]. However, many dentists still manually record patient medical records, leading to an accumulation of uncomputerized patient data [2].

An information system is a combination used to efficiently, easily, and quickly present necessary information [3]. Information systems development methodology uses a variety of techniques, including the Scrum method. One Agile development methodology called Scrum is utilized to find adaptable solutions for challenging issues inside a team or company [4]. The Scrum methods places a strong emphasis on short iterations based on the functionality of the developed system, which accelerates, improves, and expands the flexibility of development [5].

Several difficulties were observed following the author's observations and interviews at a dental practice in the Jimbaran area. The main concern discovered during these observations and interviews is that the recording of patient medical records is not yet totally digitized. This causes various issues, including long waiting times for patients due to the manual search for patient data, accumulation of paper documents because medical records are being retained manually, and difficulty in tracking patient history. As a result, a medical record information system is required to improve the efficiency of services at the dental practice.

The use of the Scrum method in this research is an ideal development strategy to apply, as it prioritizes collaboration between users and the development team. This ensures that the development process moves rapidly, meet user needs, and adapt to changes in requirements or priorities.

II. LITERATURE REVIEW

A. Medical Record

According to Indonesian Minister of Health Regulation No. 24 of 2022, medical records are papers that include patient identity information, examinations, treatments, activities, and other services delivered to the patient [1]. The term 'medical records' refers not just to documents containing patient data, but also to records held as part of an information system, such as electronic medical records, which collect all patient data related to services provided by a healthcare facility [6].

B.   Scrum Methodology

Scrum is an Agile methodology that allows people, teams, and organizations to provide adaptable solutions to complex issues [4]. The system will be developed based on user needs through sprint cycles. If the results of the first sprint do not satisfy the objective requirements, changes will be made in the following sprints [7].

C.   PHP

PHP (Hypertext Preprocessor) is a website-based programming language that runs on the server side, which means that all PHP code is executed by the web server [8]. PHP is a server-side embedded script language, which implies that all commands and program syntax can be embedded within standard HTML pages and will be entirely executed by the server [9].

D.   CSS

Cascading Style Sheets (CSS) are web documents that control the properties of HTML components to achieve the desired style [10]. CSS may manage the display formatting of any XML, SVG, or XUL document, including HTML and XHTML pages. CSS enables the separation of a document's main content from its style, color, and fonts [11].

E.   JSON

JSON (JavaScript Object Notation) is a lightweight data transmission format that computers can easily parse and generate, as well as read and write [12]. Although JSON is a text format that is fully independent of programming languages, programmers who work with C, C++, C#, Java, JavaScript, Perl, Python, and other languages are probably already familiar with its standard. This makes JSON an ideal language for data interchange.
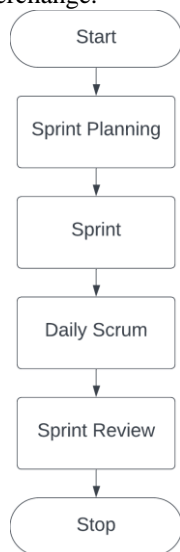

Fig. 1. Research Flow

F.   MySQL

Developed using the C and C++ programming languages, MySQL is the most widely used Open Source SQL database management system. MySQL is distributed and supported by Oracle Corporation. MySQL provides database management software for relational database management systems (RDBMS) and database servers [13].

III.   RESEARCH METHODOLOGY

In developing this Dental Practice Medical Record Information System, the author applied the Scrum method. Figure 1 shows the steps of the Scrum process.

A.   Sprint Planning

Sprint planning is the first phase of the Scrum framework. This step involves selecting backlog items from the product backlog to work on during a sprint. In addition to selecting backlog items, the team also determines the goal for the upcoming sprint.

B.   Sprint

A sprint is a period during which the Scrum team works to finish all of the backlog items assigned to that sprint. A sprint usually lasts for a maximum of four weeks.

C.   Daily Scrum

The daily scrum is a brief daily meeting held during the sprint. During the daily scrum, the team usually delivers updates on what they are currently working on, what has been completed, and any obstacles they are encountering.

D.   Sprint Review

This is the final stage of a sprint, usually conducted at the end of the sprint. During the sprint review, the team meets to review which backlog items have been completed.

IV.   RESULTS DISCUSSION

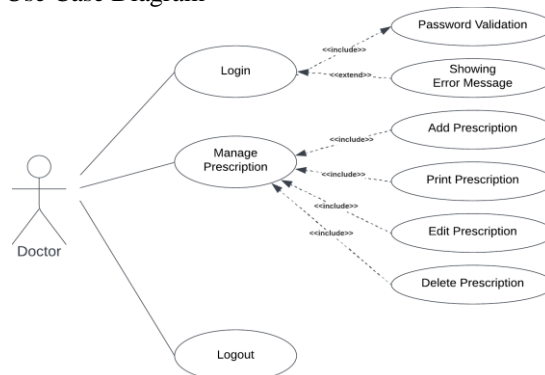*A.   Proposed System Design*

a)   Use Case Diagram

Fig. 2. Use Case Diagram

The use case diagram above provides an overview of the features of the system. This system's use case diagram shows only one actor representing user interaction: the doctor. The doctor in this use case diagram indicates the interaction of the doctor who will input the patient's medical records. The doctor has several features, including login, prescription management, and logout.

b)   Activity Diagram

The illustration of how users will interact with the system is represented by the activity diagram shown in the figure
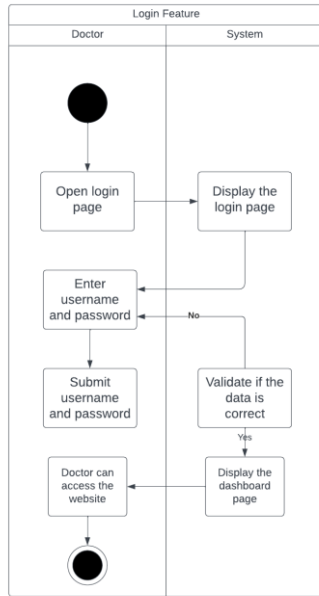
below.

Fig. 3. Activity Diagram for Login Feature

In the activity diagram for the login feature, the doctor can first access the login page. Then, the doctor will input their email and password. Next, the system will validate whether the entered data is correct or not. If the data is correct, the system will enable the doctor access. If the data is incorrect, an 'invalid login' message will be displayed.
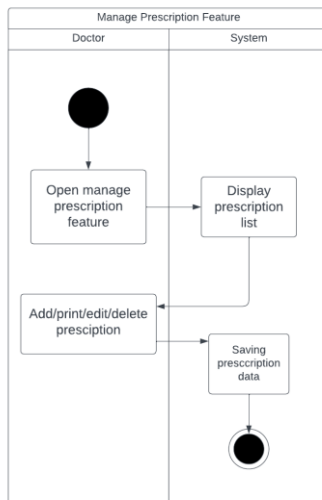

Fig. 4. Activity Diagram for Manage Prescription Feature

In the activity diagram for the manage prescription feature, the doctor will open the manage prescription feature. Then, the options to add a prescription or list prescriptions will be displayed. When the list prescriptions are displayed, the doctor can print, edit, and delete them. Then, when the doctor chooses to add a prescription, they will input the patient's medical record.

c) Sequence Diagram

The sequence diagram is used to depict and explain how the user interacts with the system's functionality.
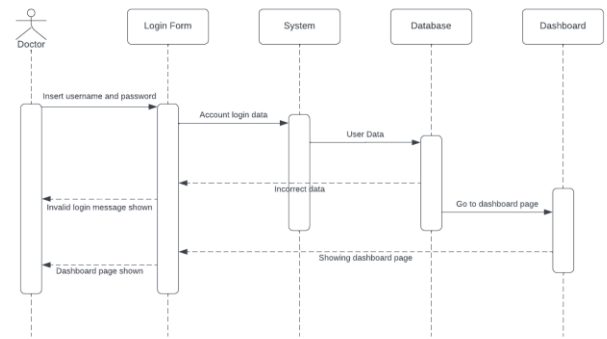

Fig. 5. Sequence Diagram for Login Feature

In the sequence diagram for the login feature, the doctor will first access the login form, then input their email and password. After that, the system will validate the entered data to the database. If the entered data is incorrect, the system will display an invalid login message. If the entered data is correct, the system will grant access to the doctor.

Fig. 6. Sequence Diagram for Manage Prescription Feature

Prescription Management Features: The doctor can add, print, edit, and delete prescription data. To add a prescription, the doctor needs to click on 'Manage Prescription,' then select 'Add Prescription,' and input the prescription data into the prescription form. The data will then be saved in the database. To view the list of prescriptions, the doctor needs to click on 'Manage Prescription,' then select 'List Prescription,' which will display the prescription data. The doctor can then print, edit, or delete the prescriptions.

B. Product Backlog

This stage is the first phase in Scrum. During this stage, the system's features are planned, and these features are then organized into the product backlog.

TABLE I
PRODUCT BACKLOG

Backlog Item	Priority	Description
Create a system overview	Medium	Creating an overview of the system using UML
Login	Medium	Users log into the system

Add Prescription	High	Users can add prescription data	
List Prescription	Medium	Users can see a list of prescription data in the system	
Print Prescription	Medium	Users can print prescription data	
Edit Prescription	High	Users can edit prescription data	
Delete Prescription	Medium	Users can delete prescription data	

In the product backlog of this system, there are 7 backlog items to be worked on, including: creating a system overview using UML, login, add prescription, list prescription, print prescription, edit prescription, and delete prescription.

C.   Sprint Planning

Sprint Planning is conducted when the team has an understanding of the product backlog to be worked on. The team will then discuss the backlog items to be completed in one sprint.

TABLE II
SPRINT BACKLOG

Date	Sprint	Backlog Item	Story Point
March 15 - 17 2024	1	Create a system overview	2
March 15 – 17 2024	1	*Login*	2
March 18 – April 6 2024	2	*List Prescription*	2
March 18 – April 6 2024	2	*Delete Prescription*	2
March 18 - April 6 2024	2	*Print Prescription*	3
March 18 - April 6 2024	2	*Edit Prescription*	5
March 18 - April 6 2024	2	*Add Prescription*	13

D.   Daily Scrum

In this daily scrum, the team updates on what work is being done, what has been completed, and any obstacles being faced. As shown in Table 3, the 29 story points decrease to 0, indicating that all backlog items have been completed.

TABLE III
DAILY SCRUM

Tasks	Start Date	End Date	Story Points	Remaining Story Points
Create a system overview	3/15/2024	3/16/2024	2	27
Login	3/16/2024	3/17/2024	2	25

Add Prescription	3/19/2024	4/3/2024	13	12
Edit Prescription	3/19/2024	3/26/2024	5	7
List Prescription	3/19/2024	3/20/2024	2	5
Delete Prescription	3/21/2024	3/21/2024	2	3
Print Prescription	3/24/2024	3/24/2024	3	0

E.   Sprint Review

In the sprint review stage, the team will hold a meeting at the end of the sprint to evaluate how the sprint went. Table 4 shows the findings of the sprint review.

TABLE IV
SPRINT REVIEW

SPRINT	SPRINT REVIEW
1	In the first sprint, all tasks proceeded smoothly, despite some obstacles such as synchronizing the model, view, and controller. However, the team managed to overcome these challenges effectively
2	During the second sprint, the team experienced a number of obstacles, especially related to tasks involving adding and editing prescriptions. These issues stemmed from the odontogram in the prescription, necessitating research to create the odontogram. The team struggled with displaying teeth in the prescription, synchronizing data in the edit prescription, saving data in JSON format in the database, and creating the odontogram interface. Despite taking a considerable amount of time to complete all tasks during the second sprint, the team eventually managed to finish them successfully.

F.   Sprint Result

During the first sprint, which ran from March 15 to 17, the team worked on the first backlog item, creating the system overview. The results are shown in Figure 2. In addition, in this first sprint, the author also completed the second backlog item, which was the login feature.
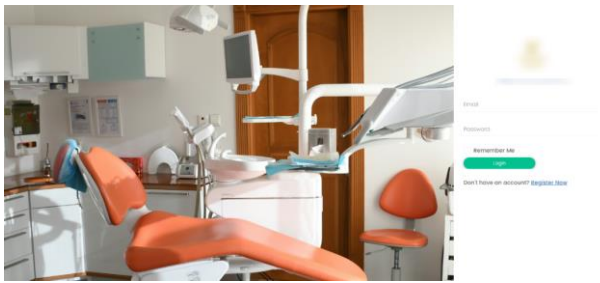
Fig. 7. Login Page

The login page in the figure above is the realization of the activity diagram in Figure 3 and the sequence diagram in Figure 5. On the login page, the doctor will input their email and password. After that, the doctor will click login to proceed to the next page. The system will next validate the entered data with the database. If the entered data is correct, it will proceed to the next page. If the entered data is incorrect, an invalid login message will be displayed.

Next, in the second sprint, the team completed the manage prescription feature. Figure 8 is the realization of the activity diagram in Figure 4 and the sequence diagram in Figure 6. In the add prescription process, the doctor will first select the patient whose medical record will be entered. Then, the doctor can choose which doctor did the examination. Following that, the doctor can input patient data such as weight, height, prescription creation date, case history, odontogram, and prescription entry.
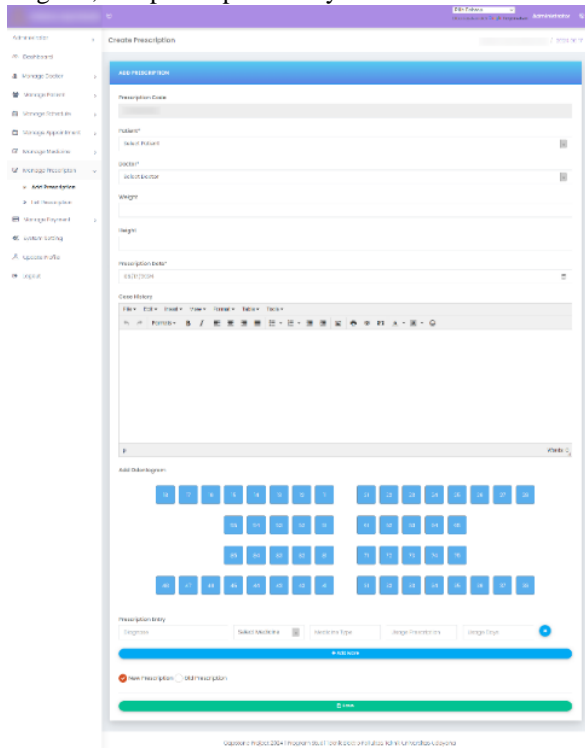

Fig. 8. Add Prescription

In filling out the odontogram, the doctor can click on the tooth number that has to be noted. Then, the doctor can select which part of the tooth has a disease, which can be chosen in a checkbox. Next, the doctor can select the category of the tooth disease that corresponds to the patient, and can also add notes. Figure 9 shows the display of the Odontogram Notes.
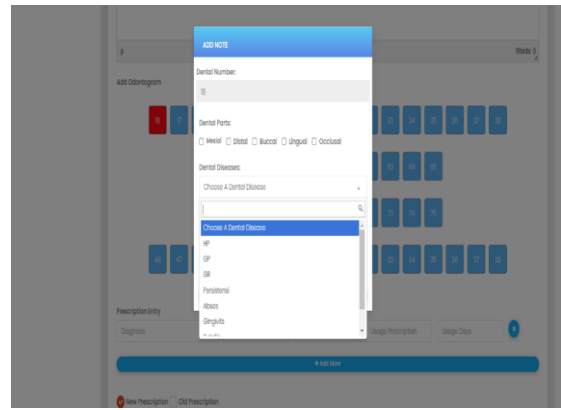

Fig. 9. Odontogram Notes

When doctors have saved prescription data, they can view all prescriptions stored by the system on the list prescription page. This page displays the patient's name, the date the prescription was created, the prescription status, and several actions that can be performed on the prescription data, such as print, edit, and delete.
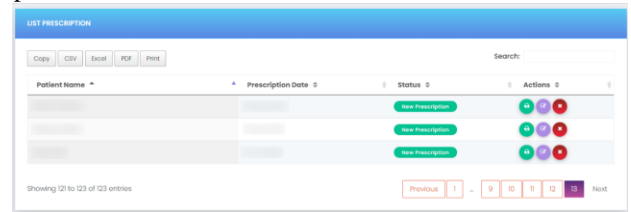

Fig. 10. List Prescription

In Figure 10, the doctor can print the prescription from the actions section. When the doctor clicks 'print,' the saved data on the database will be displayed, including the doctor's name, patient data, the patient's odontogram, and the medication prescribed to the patient, as shown in Figure 11.
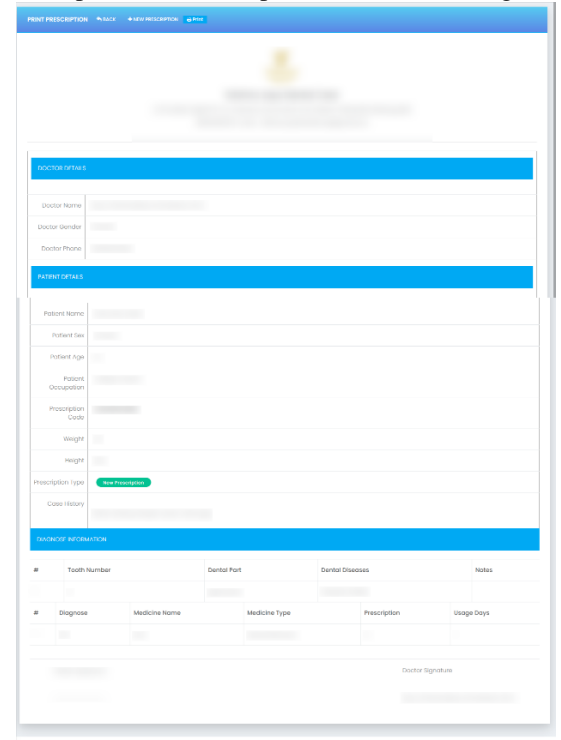

Fig. 11. Print Prescription

Next, the doctor can also edit prescriptions by selecting the edit button located in the action section of Figure 12. On the edit prescription page, the doctor can change any data that needs to be updated. After making the changes, the doctor can click save to save the updated prescription data.

G.　Burndown Chart

During the entire completed sprints, a total of 29 story points were worked on from March 15 to April 6, 2024. In the development process, the backlog items in the product backlog were divided into 2 sprints. The progress of the work from a total of 29 story points to 0 or when the story points are exhausted can be seen in the burndown chart in Figure 13. Although the work was generally good, there was a lag during the 'add prescription' and 'edit prescription' tasks. This was due to issues in selecting the display and data synchronization within the odontogram in the prescription. After these issues were addressed, all story points were completed ahead of schedule.
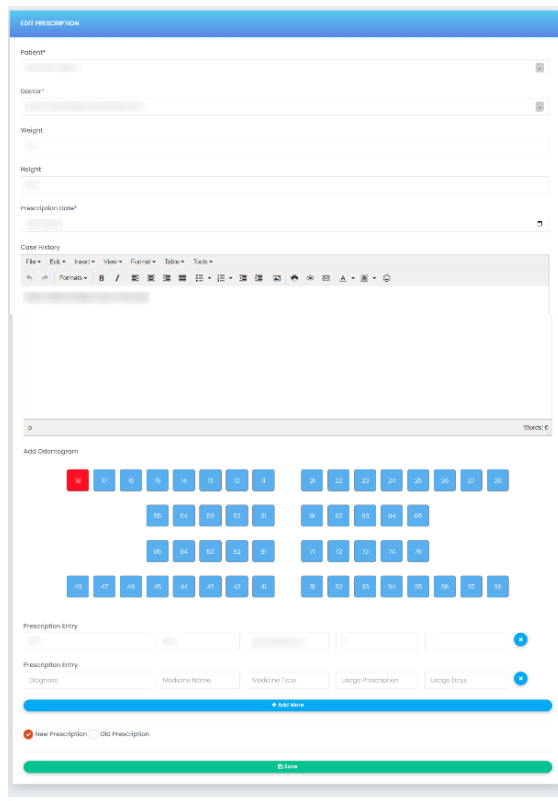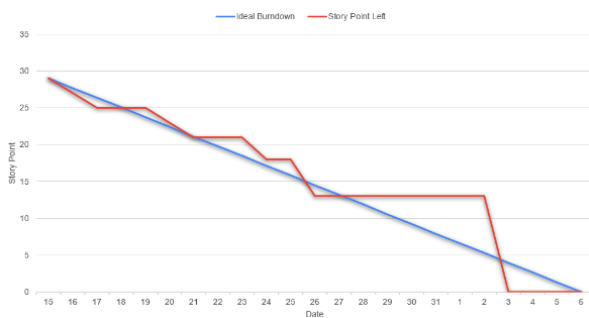

Fig. 12. Edit Prescription

Fig. 13. Burndown Chart

V.　Conclusion

Scrum implementation in the development of a Dental Practice Medical Record System was accomplished by completing all existing product backlogs. The implementation of the adaptive and flexible Scrum methodology has helped to facilitate and save time in the work process. In developing the information system using the Scrum method, 29 story points were successfully completed during the sprint period from March 15 to April 6, 2024. During the sprint, there were issues with inserting the odontogram into the prescription. This delay is reflected in the burndown chart, where the project graph exceeded the ideal burndown graph. However, once the issue was resolved, the project was completed ahead of the initial target.

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