Application of Scrum Method in the Design of Water Bill Payment Report Information System at BUMdes Mbinalun

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ABSTRACT

An information system comprises components that process data, transforming it into meaningful information and assisting in the achievement of organizational objectives. The report information system on the design and development of this system is web-based, using the scrum methodology, which has flexible properties to develop a data processing application. However, the information system for processing water bill report data carried out at BUMDes Mbinalun still uses Microsoft Excel, so that the resulting data contains many errors in its management. Thus, the Scrum method makes work or data processing neater because the development process uses sprints, which are development activities to achieve small goals (which are broken down from the main goal) that usually take 2-4 weeks, which is called TimeBox. The final result of this work is a web-based water bill payment report system to make it easier to record water bill reports such as customer data, basic tariff data, and usage data. Apart from that, the design of the water bill payment report information system also provides information in the form of reports that can be printed directly, and customers can view bill data on the web.

1. INTRODUCTION

Information systems are several components that process data so that the processed data can be used as meaningful information and can help achieve organizational goals[1]. The reporting information system in the design and development of this system is web-based by utilizing the scrum methodology, which has a flexible nature to develop a data processing application[2]. Scrum is a responsive framework for developing software, managing products, or developing applications. Scrum has a complex process where many factors influence the final result[3], [4]. Thus, the scrum method makes data processing work neater. The data used in this scrum method is water bill payment report data. The usual data reporting process is still by inputting data into Microsoft Excel. So that the process of managing this report data can hinder the process of managing monthly usage reporting, and there are errors in recording water bill reports, such as customer data, basic tariff data, and usage data that are still not running well.

BUMDes (Village-Owned Enterprises) is a village-owned business institution managed by the community and village government in an effort to strengthen the village economy and is formed based on the needs and potential of the village[5]. BUMDes Mbinalun, located in Mbinalun Village, is a service and business in various fields, one of which is engaged in water bill management[6], [7]. However, the information system for processing water bill report data carried out at BUMDes Mbinalun still uses Microsoft Excel so that the data produced contains many errors in its management. Based on the problems above, this system can help officers in managing water bill reports.

2. LITERATURE REVIEW

Design is a process of defining, designing, describing or building one independent element at a time into a complete functional unit[8]. An information system[9] is a collection of components that process data so that the processed data can be used as meaningful information and can help achieve organizational goals[1], [10]. Payment is the process of transferring a sum of money from one party to another as payment or as fulfillment of an obligation[11]. Payment procedures usually include rules involving the pay and the payer. Billing is an obligation that must be paid by customers for all use of services and facilities available[12]. Bills that must be paid include the amount of fines, interest, administration fees, and other fees[13]. Water is clean

water that is healthy and safe to drink, colorless, odorless, and has a fresh taste[14]. BUMDes or Village-Owned Enterprises is a legal entity business unit established by the village that is useful for managing economic resources in an area. BUMDes aims to improve the village economy, increase community businesses, accelerate development at the local level and grow and develop local economic potential[15]. Scrum is a design method with an iterative and incremental approach to filter out predictable things and control damage due to initial design errors[16], [17].

3. RESEARCH METHODS

3.1 Type of Research
The construction of a water bill payment information system at BUMDes Mbinalun is the primary subject of this sort of research, which employs a qualitative methodology. An analysis of the needs, the design of the system, the execution, and the evaluation are all parts of the research process.

3.2 Data Collection Stage
This study employs observation and literature review as its data collection methods.
1. Observation: This approach involves the careful examination and analysis of current issues in the field that pertain to the subject of interest.
2. Literature study: This approach involves seeking out relevant materials to clarify the problem by utilizing books, journals, and online resources.

3.3 Analysis of the Running System
At this stage, the results of data collection are studied and evaluated from various existing problems starting from the initial process to the final process in the water bill payment reporting system. The results of the analysis collected are also used by researchers to submit a proposed system and the needs of the system to be developed[18].

3.4 System Development Stage
The system development method used is scrum. The stages of the scrum method consist of forming a scrum team, creating a product backlog, sprint phases (sprint planning, sprint backlog, daily scrum, sprint review, and sprint retrospective).

4. DISCUSSION AND RESULT

4.1 Create a Product Backlog
At the stage of creating this backlog product, the determination of the backlog features is made based on the priority by the product owner. The list of features can be seen in table 1 as follows.

Table 1. Product Backlog

No	Backlog Item	Importance (1-100)	Estimated Time (Days)	Demo Description
1.	Creation of UML Diagram	100	4	Review the designed UML diagram to ensure it meets the specified requirements.
2.	User Login	100	3	Click the login button and enter the required information; successful login occurs if the username and password are correct.
3.	Home Dashboard	100	3	Displayed upon successful login.
4.	Management of Usage Data	100	3	Administrators and staff can view, add, edit, and delete usage data.
5.	Management of Tariff Data	100	3	Administrators can view, add, edit, and delete tariff data.
6.	Management of Customer Data	100	3	Administrators can view, add, edit, and delete customer data.
7.	Management of Reports	100	4	Administrators can view and print report data.
8.	Verification of Customer Water Billing Data	80	4	Customers can view their water billing data by entering their account number into the input form.
8.	User Logout	100	3	Click the logout button to exit the website.

4.2 Sprint Phase
At this stage, the sprint is determined based on the product backlog table. The resulting sprint is 2 Sprints with consideration of backlog features, tasks, and time estimates (days) according to scrum rules, which will later become the sprint backlog. The following are the stages of events (scrum events) in each sprint. The sprint planning stage is carried out at the

beginning of the sprint in order to plan the work to be done in the sprint. The result of sprint planning is the sprint backlog. Here are the results of sprint planning from sprint 1 to sprint 2.

Table 2. Sprint Backlog for Sprint 1

No	Backlog Item	User Story	Task	Est (Days)
1.	UML Design		Create use case diagram	2
			Create activity diagram	2
2.	Login Page	As an administrator, I can log into the system.	Create database schema for login	0,5
			Design UI for the login page	0,5
			Implement UI design for the login page in code	0,5
			Test the login page	0,5
3.	Dashboard Page	As an administrator, I can navigate to the dashboard page.	Design the dashboard page	1
			Implement UI design for the dashboard page in code	1
4.	Tariff Management Page	As an administrator, I can add, edit, and delete tariff data.	Create database schema for tariff management	1
			Design UI for tariff management	0,5
			Implement UI design for tariff management in code	1
			Test the tariff management feature	0,5
5.	Customer Management Page	As an administrator, I can add, edit, and delete customer data.	Create database schema for customer management	1
			Design UI for customer management	0,5
			Implement UI design for customer management in code	1
			Test the customer management feature	0,5
6.	Usage Management Page	As an administrator, I can add, edit, and delete usage data.	Create database schema for usage management	1
			Design UI for usage management	0,5
			Implement UI design for usage management in code	1
			Test the usage management feature	0,5
		TOTAL		17

Table 2 shows 6 backlog items and 17 estimates obtained from the planning as follows:
- Sprint time: 4 weeks
- Objective: Produce UML design, login page, dashboard page, rate management page, customer management page and usage management page[19].
- Calculation of estimated team velocity to determine story points in sprint:
  Sprint length = 4 weeks. However, in 4 weeks there are 10 non-effective days (Saturday, Sunday and holidays) so, there are 20 effective days.

$$Man\text{-}days = 2\ (team\ members\ \times\ 20\ (effective\ days) = 40$$
$$Focus\ factor = \frac{Actual\ Estimated\ Velocity}{man\text{-}days} \times 100\%$$
$$= \frac{17}{40} = 0,425 = 42,5\%$$
$$Estimated\ Velocity = Man\text{-}days\ \times\ focus\ factor$$
$$= 40\ \times\ 42,5\% = 17$$

Based on the team's estimated speed, the number of stories that can be included in sprint 1 is 17 story points.

Table 3. Sprint Backlog for Sprint 2

No	Backlog Item	User Story	Task	Est (Days)
1.	Report Management Page	As an administrator, I can view and print reports.	Design UI for annual usage history report	1
			Develop code for annual usage history report	1
			Test the annual usage history report feature	1
2.	Customer Water Billing Data Check Page	As a customer, I can check my water billing data.	Design UI for checking customer water bills	1
			Develop back-end code for checking customer water bills	1
			Test the customer water billing check page	1
3.	Admin Logout Feature	As an administrator, I can log out of the system.	Create database schema for admin logout	0,5
			Design UI for admin logout	0,5
			Implement UI design for the admin logout page in code	0,5
			Test the admin logout feature	0,5
			TOTAL	**8**

Table 3 shows 3 backlog items and 8 estimates obtained from the planning as follows:
- Sprint time: 2 weeks
- Objective: Produce a report management page, a customer water bill data check page and an admin logout feature.
- Calculation of estimated team speed to determine story points in the sprint:
  Sprint length = 2 weeks. However, in 2 weeks there are 2 non-effective days (Saturday, Sunday and holidays) so there are 8 effective days.

$$Man\text{-}days = 2 \text{ (team members)} \times 8 \text{ (effective days)} = 16$$
$$Focus\ factor = \frac{Actual\ Velocity}{man-days} \times 100\%$$
$$= \frac{8}{16} \times 0{,}5 = 50\%$$
$$Estimated\ Velocity = Man-days \times focus\ factor$$
$$= 16 \times 50\% = 8$$

Based on the team's estimated speed, the number of stories that can be included in sprint 2 is 8 story points.

4.3 Daily Scrum

The next stage is the daily scrum, which is a scrum activity that is held almost every day by the development team. In this daily meeting, discuss what has been completed on the sprint backlog by updating the burndown chart. Here are the results of the burndown chart for sprint 1 to sprint 2.
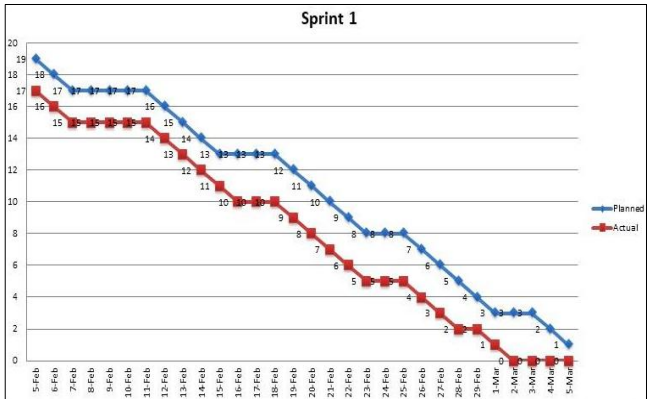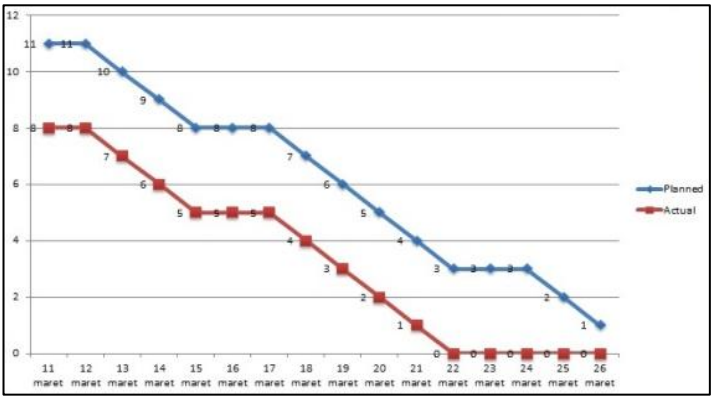

Figure 1. Burndown chart – sprint 1

Figure 2. Burndown chart – sprint 2

Figure 1 above illustrates that the first day of the sprint is February 5th. Then, on February 6th, 1 story point was completed by the crew. Then, the team adjusts the burndown chart, which previously on February 5th estimated work remaining 17 story points to 16 story points on February 6th and so on. Figure 2 depicts the first day of sprint 2 is February 28th. Then, on February 28th, 1 narrative point has been completed by the team. Then, the team adjusts the burndown chart, which previously on February 28th estimated work remaining 8 story points to 7 story points on February 29th and so on.

4.4 Sprint Review

The next phase is sprint review. In this phase, discuss what has been done by the team from all sprint backlogs to review the Increment and change the Product Backlog if necessary. Here are the results of the sprint review from sprint 1 to sprint 2.
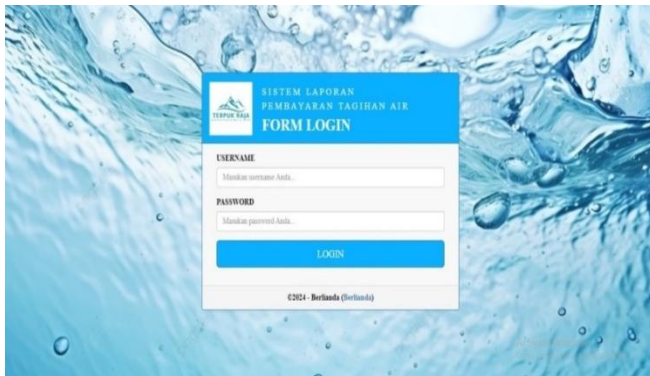
Figure 3. Admin Login Page

Figure 4. Admin Dashboard Sprint 1
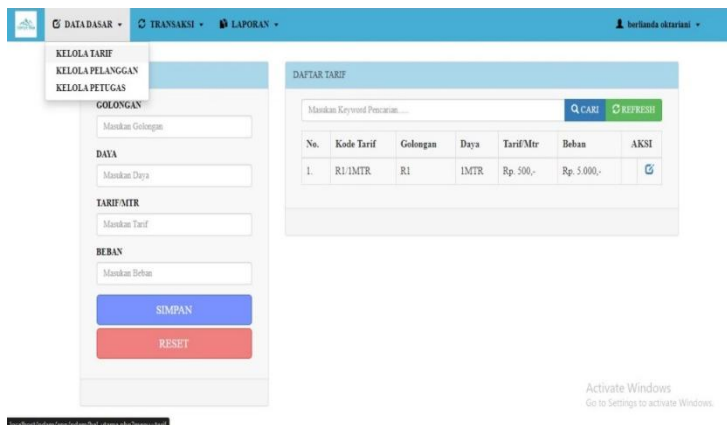
Figure 5. Tariff Management Page
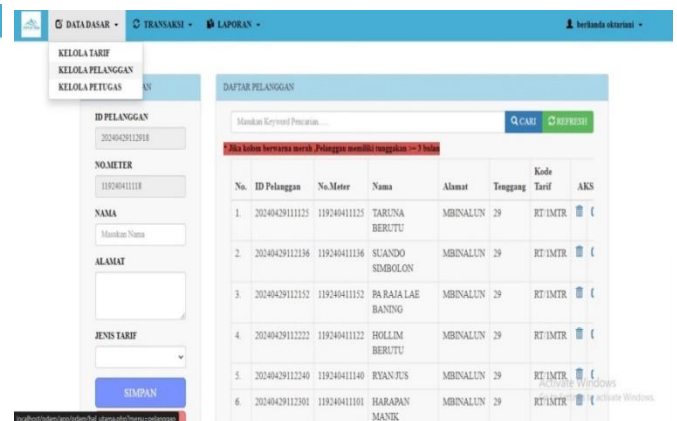
Figure 6. Customer Management Selection Page Sprint 1
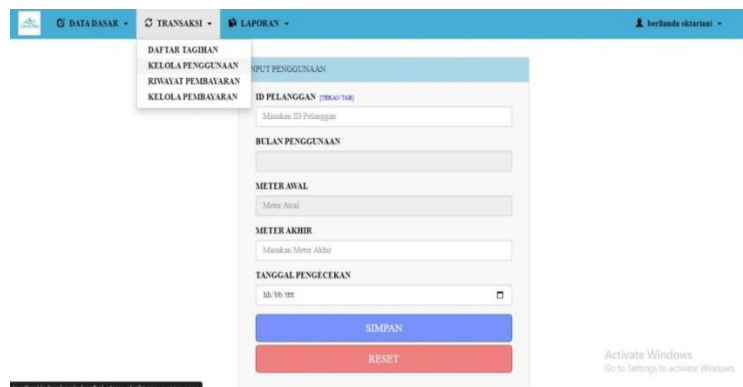
Figure 7. Usage Management Page Sprint 1

Figure 8. Report Management Page

Figure 9. Report Printing Page Sprint 2

Figure 10. Customer Water Billing Check Page

Figure 11. Admin Logout FeatureSprint 2

5. CONCLUSION

It can be concluded from this final project research that the web-based water bill payment reporting system case study at BUMDes Mbinalun has been built using the Scrum method where this method can overcome changes during the system development phase and scrum has iterative stages where if the product in the first sprint is not sufficient to meet the needs, then in the next sprint a system can be developed that is in accordance with user evaluation and this water payment reporting system in the future is expected to not only be web-based, but can be developed into a Stand-Alone application.

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