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Research Article

Implementing Agile Scrum Methodology in the Development of SMART PEKAN at Batu City Environment Service

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Abstract.
The preparation of reports on the activities of the functional position group for the Batu City Environmental Service is still being carried out in the usual way. Making announcements on activities at any time must begin by creating a new page. That matter could be more effective and efficient because the structure of each activity report is the same. This research aims to develop a report creation system whose workings make it easier for users to create activity reports. The system makes the activity reports according to users needs based on the information obtained during interviews and observation. The system is developed using the Agile framework with the Scrum method. This research produces SMART PEKAN (Functional Position Group Activity Report Creation System), a website that makes reports on Functional Position Group activities using automatic report templates. SMART PEKAN can be a tool that facilitates making reports on the activities of users by utilizing the progress of an existing technology to implement digital transformation in the government sector to support the Smart City movement.

Keywords: activity reports, agile, innovation, reporting system, scrum, service for the environment

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1. Introduction

The topic of “digital transformation” is frequently discussed nowadays, but the idea was first proposed in the late 1990s and was brought up once more in the middle of the 2000s1. The phrase “digital transformation” can be broken down into two words: “digital” and “I.T.” were originally interchangeable terms, but their meanings have since changed. A company’s digital strategy now determines the roadmap and objectives of many divisions, from processes to services to products. Additionally, “transformation” refers to how digital applications promote new kinds of creativity and invention in a particular field rather than just enhancing and supporting conventional approaches

[1]. A more specific definition of “digital transformation” could be “going paperless,” impacting individuals and corporations.

To successfully implement Agile Scrum methodology in the development of local government, it is crucial to address the challenges and issues associated with distributed Scrum [2]. Distributed development poses unique challenges that need to be overcome to ensure sustainable development [2]. Additionally, auditors can utilize a proposed framework to audit Agile projects implemented using Scrum methodology, ensuring the successful completion of IT projects [3]. Moreover, incorporating quality control activities in Scrum is essential, particularly regarding the concept of the test backlog [4]. This underscores the importance of maintaining quality standards within the Agile Scrum framework.

Furthermore, the implementation of the Scrum framework in the development of a quality assurance information system demonstrates the practical application of the Agile development methodology [5]. It highlights the relevance and applicability of Scrum in ensuring the quality of information systems. Additionally, an analytical evaluation of Scrum as a popular Agile management methodology further supports its significance in modern development practices [6]. Moreover, the challenges and limitations of Agile methodologies, including Scrum, in fulfilling the requirements of large-scale projects have been observed [7]. This emphasizes the need for a comprehensive understanding of the potential limitations and challenges that may arise during the implementation of Agile Scrum in large-scale projects.

The development of city development in the world has recently undergone significant changes due to the influence of information technology (I.T.), so these cities are defined as smart cities [8]. Generally, several factors, such as human, technological, and institutional factors, support the bright city concept in a city like this [9]. In Indonesia, to support the formation of an intelligent nation, the Director of General of Regional Autonomy of the Ministry of Home Affairs is preparing regulations regarding intelligent cities. The smart city in Batu City is a concept run by Diskominfo, using a single platform with the help of technology; in general, this intelligent city is assisted by three interrelated infrastructures [10].

An essential part of bureaucratic reform is the administration of central and local government [11,12]. This is considered necessary because part of the success of policies is also determined by the ability of the state bureaucratic administration to implement policies effectively and efficiently. All internal functions of the institution are measured

against performance accountability and in terms of individual performance, work unit performance, institution performance, and overall management performance [13]. The government made A.S.N. more professional with Law Number 5 Year 2014 on State Civil Apparatus. This law provides a foundation for implementing civil state administration as part of building a state civil apparatus that is honest, professional, impartial, politically neutral, free from conspiracy, corruption, and nepotism (K.K.N.), and able to provide quality public services for the community. Quality public services for the community.

Government regulations in Law Number 5 of 2014 concerning the State Civil Apparatus (A.S.N.) state that regional A.S.N. management is carried out by regional government agencies where A.S.N. has the right and obligation to prioritize the principles of A.S.N. [14]. A.S.N. has the right and obligation to prioritize the principle of proportionality by the duties to be accountable to the local government [13]. Its performance is monitored by considering the tasks, time, results, and benefits achieved to assess A.S.N.'s career development record by considering integrity and morality for A.S.N. in calculating its class rank increase [15].

With the existence of this law, one of them must be a professional employee and be accountable for their performance results. Therefore, A.S.N. must create an activity report document to be accountable for its performance results after carrying out its designed activities. Activities designed. Including the functional position group of D.L.H. Batu City, in every implementation of activities by the R.H.K. (Work Result Plan), must make a report that will be sent to K.L.H.K.

D.L.H. Batu City has three fields: environmental structuring and compliance, pollution control, environmental maintenance and landscaping, waste management, and hazardous and toxic waste management. Each of these consists of functional position groups. Each functional position takes and determines the R.H.K. (work result plan) according to the main tasks and functions carried out during the work dialog. Functions performed during the work dialog. Every activity related to R.H.K. must be made an activity report after the activity takes place to be reported to the K.L.H.K.

The preparation of activity reports at the Batu City Environmental Service is still not done with the system. The Batu City Environment Agency still does not have its activity reporting system, so the Functional Position Group still needs to work on reports in the usual computerized way. As a result, the resulting report reports are still not organized. It also requires more effort and takes up much time. Time. In supporting

digital transformation efforts organized by the government, changes are needed in the reporting activities of the Batu City Environmental Service.

Based on the background, this research aims to develop a system that can help the process of making activity reports. This is done so that the work of the Batu City Environmental Service Functional Position Group report can be more effective and efficient. System development is carried out using the Scrum pattern Agile development method to make it easier for the system development team to handle if there are changes during the development process.

2. Literature Review

To implement Agile Scrum methodology in the development of local government, it is essential to understand the challenges, success factors, and best practices associated with this approach. The literature provides valuable insights into the implementation of Agile Scrum in various organizational settings. For instance, [15]. discuss the practices, challenges, and success factors in scaling Agile in large organizations, providing guidance for action research within software companies [15]. Similarly, [2] conducted a systematic literature review to identify challenges limiting the use of Scrum in globally distributed software development and explore mitigation strategies adopted by practitioners [2]. These studies offer valuable insights into the challenges and strategies for effectively utilizing Agile Scrum in diverse organizational contexts.

Furthermore, the literature emphasizes the need for tailored Agile methodologies to suit the unique culture and best practices of organizations. highlight the importance of implementing a blended Scrum model that integrates an organization's unique culture and best practices with Agile methodologies [16]. This suggests that a one-size-fits-all approach may not be suitable for implementing Agile Scrum in the local government context, and customization based on the specific needs of the government is crucial.

Moreover, the literature underscores the significance of understanding the factors contributing to successful Agile Scrum adoption [17]. identify factors that significantly contribute to Scrum adoption, emphasizing the importance of these factors in the successful implementation of Agile methodologies [17]. Additionally, [18] provides insights into how practices from different Agile process models have been integrated into the Scrum framework to enhance productivity and product quality, highlighting the potential for improvement through the incorporation of diverse Agile practices [18].

3. Methods

In this study, data collection was carried out through (1) Interviews conducted directly with Batu City Environmental Service resource persons. The interview aims to explore further information and confirm the information obtained. Interviews were conducted by asking questions to sources related to the problems experienced. Interviews are conducted to find out the problems that occur so that relevant solutions to these problems can be formulated. The results of the interview will be followed up using the design thinking method and also the design sprint which will then be validated by partners, namely the Batu City Environmental Agency; (2) Observation is a direct observation of the object to obtain data. Observation is carried out by observing users by directly visiting the Batu City Environmental Service. Observation aims to make researchers better understand environmental conditions and user situations.

System development is done using the Agile Software Development framework with the Scrum method. The following are the stages in Scrum:

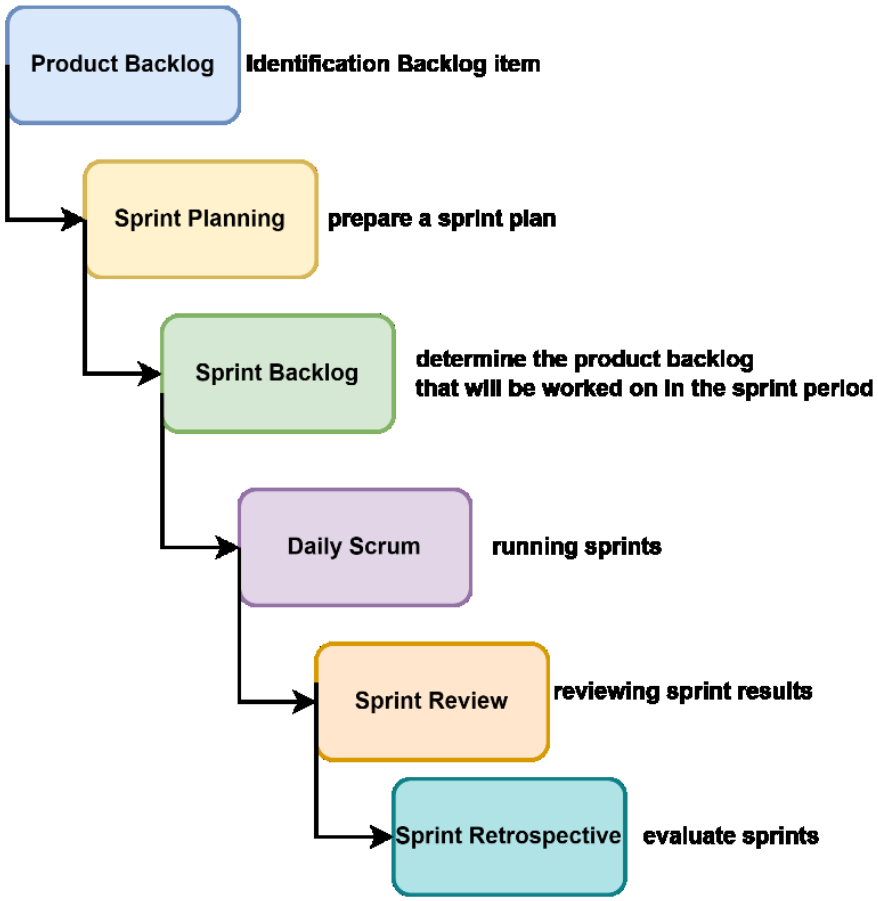

Figure 1: Stages in Scrum.

a. Product backlog is a list of things needed to increase the product's value. The product backlog contains features or functions that will be implemented in the system. The preparation of the product backlog is based on the requirements obtained from data collection. Requirements on the product backlog are dynamic, along with product development to produce a sound system.

b. Sprint planning is the stage in working on the product backlog that the scrum team will do during the Sprint. Sprint planning discusses the reasons for the sprint, things to do during the sprint and work that meets the Definition of Done.

c. Sprint backlog is the result of sprint planning activities. The sprint backlog contains the sprint objectives, the selected product backlog items, and the plan for generating increments during the sprint phase.

d. The daily scrum is a meeting held by developers to monitor progress in achieving sprint goals and adjusting the sprint backlog, as well as adjusting the work plan in the Sprint.

e. Sprint Review

At this meeting, the developer team will present the work to stakeholders to get feedback. The Scrum team and stakeholders will review what was accomplished during the Sprint and the changes. The purpose of this meeting is to check the results of the Sprint and adjust changes to the product backlog.

f. Sprint Retrospective

In this meeting, the Scrum Team will review the last Sprint held about individuals, interactions, processes, tools, and the Definition of Done. It also discusses what went well during the Sprint, the problems encountered, and how those problems have been/will be dealt with or not. The Sprint Retrospective aims to make plans to improve quality and effectiveness.

4. Result and Discussion

In this research, the problem faced by the Batu City Environmental Service is related to the making of activity reports that are done manually, which are still considered ineffective. Based on the design thinking process carried out by the team, a problem statement was found: Users need to do activity reporting that makes work easier and does not take up much time and quickly archive reports because they have many

activities that must be carried out, doing the same report format manually can take up time and need to have an archive of activity reports in an easily accessible system.

After brainstorming, it was agreed to create a website-based system to make activity reports to overcome this problem. The website-based system for making activity reports for functional position groups is called SMART PEKAN. The reason for choosing a solution in the form of a system is that it makes it easier for users to make activity reports.

The system development was done using an agile framework with the Scrum method. Scrum was chosen because this methodology is adaptive, iterative, fast, flexible, and effective. In addition, Scrum can support product development in various industries and projects to overcome complex problems. Scrum involves users in system development to produce products that meet user needs.

The following are the stages of system development using Agile Scrum:

4.1. Product backlog

The first stage in system development is to create a product backlog. The product backlog is created after analyzing the activity process and user needs after the data collection. The product backlog is arranged based on the priority of the needs that must be developed in the system. Based on the results of the analysis that has been carried out, the product backlog contains the features to be made and the priority level in Table 1 as follows:

After determining the features to be created, proceed with creating a system design. This modeling helps visualize the design and build the system to match the predetermined standards. Making designs is made in the form of diagrams, among others:

4.1.1. Use case diagram

Use Case Diagrams to identify the interactions between the system and its actors. This diagram shows what the system does and how actors use it. Actors in the reporting system are divided into two actors with their activities: users and admins. The user (user) consists of a group of Batu City Environmental Service functional positions. The admin is responsible for user data so users and admins can register accounts.

TABLE 1: Product backlog.

No.	Product Backlog	Priority
1	Sidebar	High
2	Header	High
3	Footer	High
4	Login Page	High
5	Dashboard Page	High
6	Archives Page	High
7	RHK Page	High
8	Report Page	High
9	Profile Page	High
10	Help Center	Medium
11	Logout	High
12	Search Feature	Medium
13	insert pictures Feature	High
14	Edit Feature	High
15	Delate Feature	High
16	Read/ View Feature	High
17	Create Feature	High
18	Print Feature	High
19	Dashboard Admin Page	High
20	Register Page	High
21	Admin dan Data User (CRUD) Page	High
22	PDF Feature	High
23	Download Feature	High
24	Draft Feature	Medium
25	RHK Intervensi Page	High

4.1.2. Activity diagram

After creating a use case diagram, the next step is to identify the process of making reports by creating an activity diagram. Activity diagrams show the flow from one activity to another in a system.

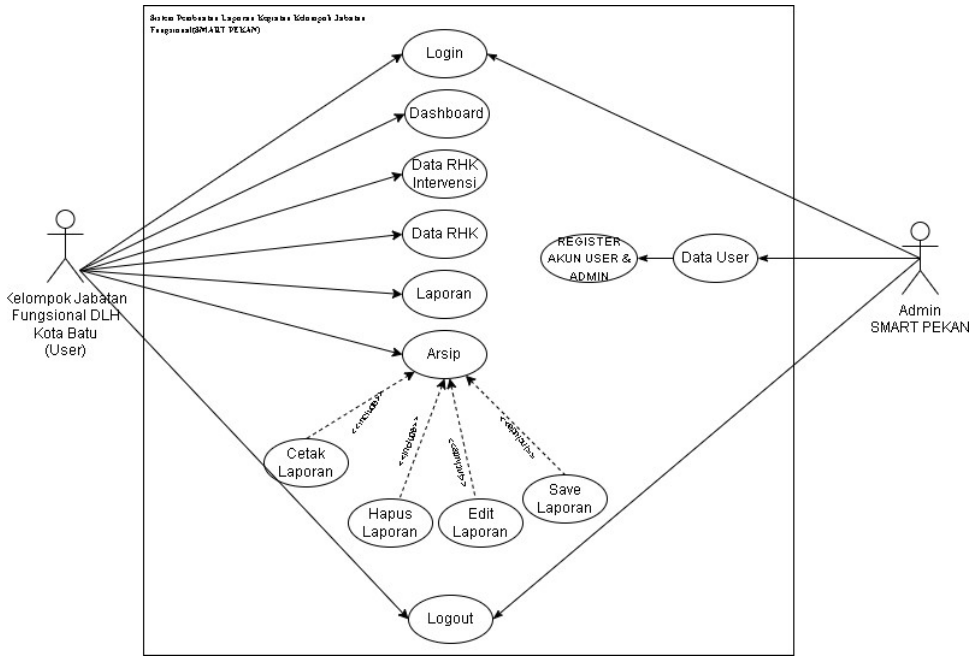

Figure 2: Use case diagram user.

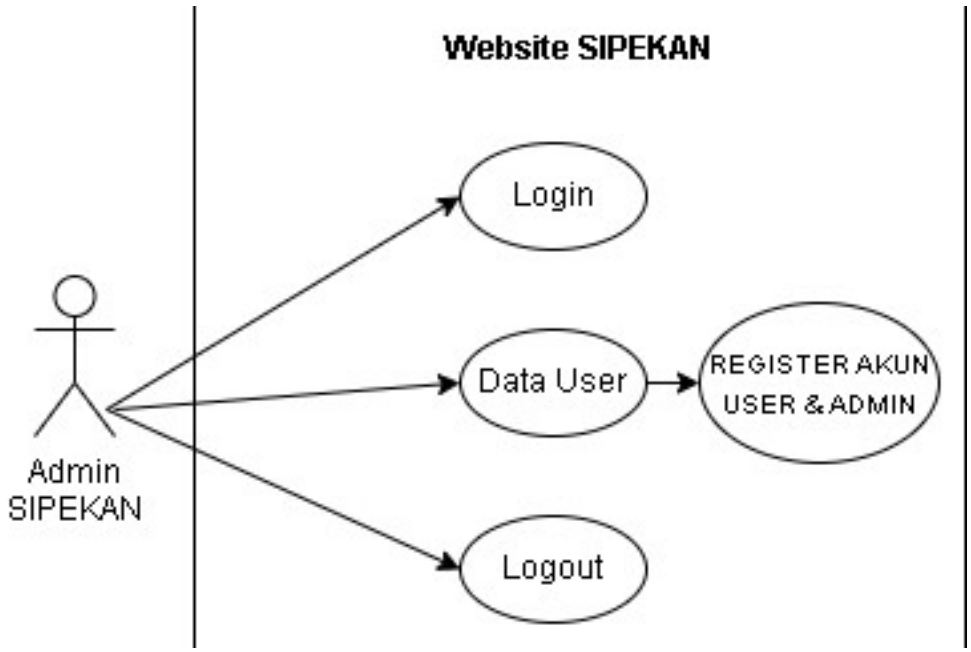

Figure 3: Use case diagram admin.

4.1.3. Sequence diagram

A sequence Diagram is an interaction diagram that describes the operation and message sequence of a group of objects working together. This diagram is used to understand new system requirements or document existing processes.

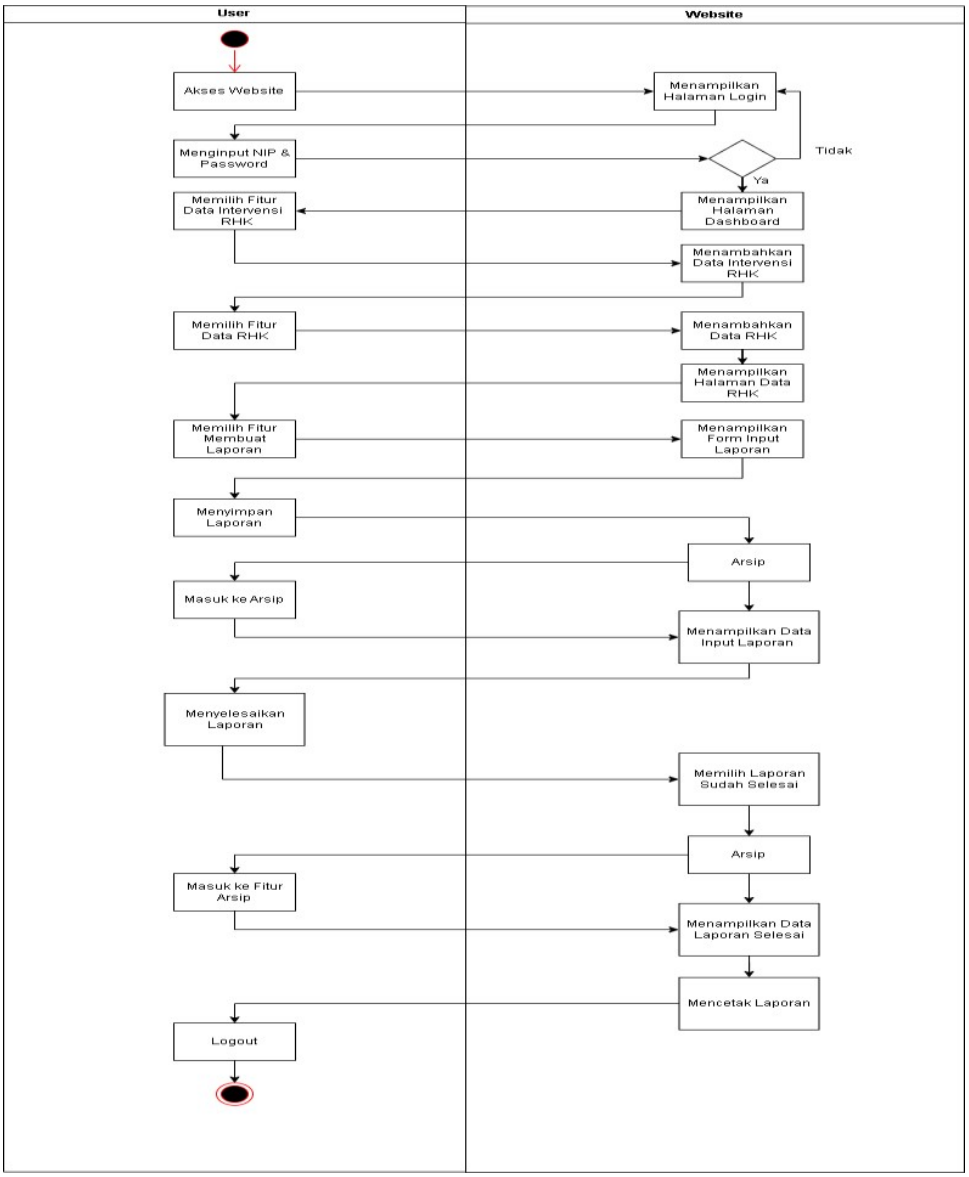

Figure 4: Activity diagram user.

4.1.4. Entity Relationship Diagram (E.R.D.)

Entity Relationship Diagram (E.R.D.) is a diagram used for designing a database and shows the relationship between objects or entities and their attributes in detail.

4.1.5. Logical relational structure

Logical Record Structure (L.R.S.) is a way or technique to describe the database as relationships between tables that transform E.R.D. to L.R.S. through the cardinality process.

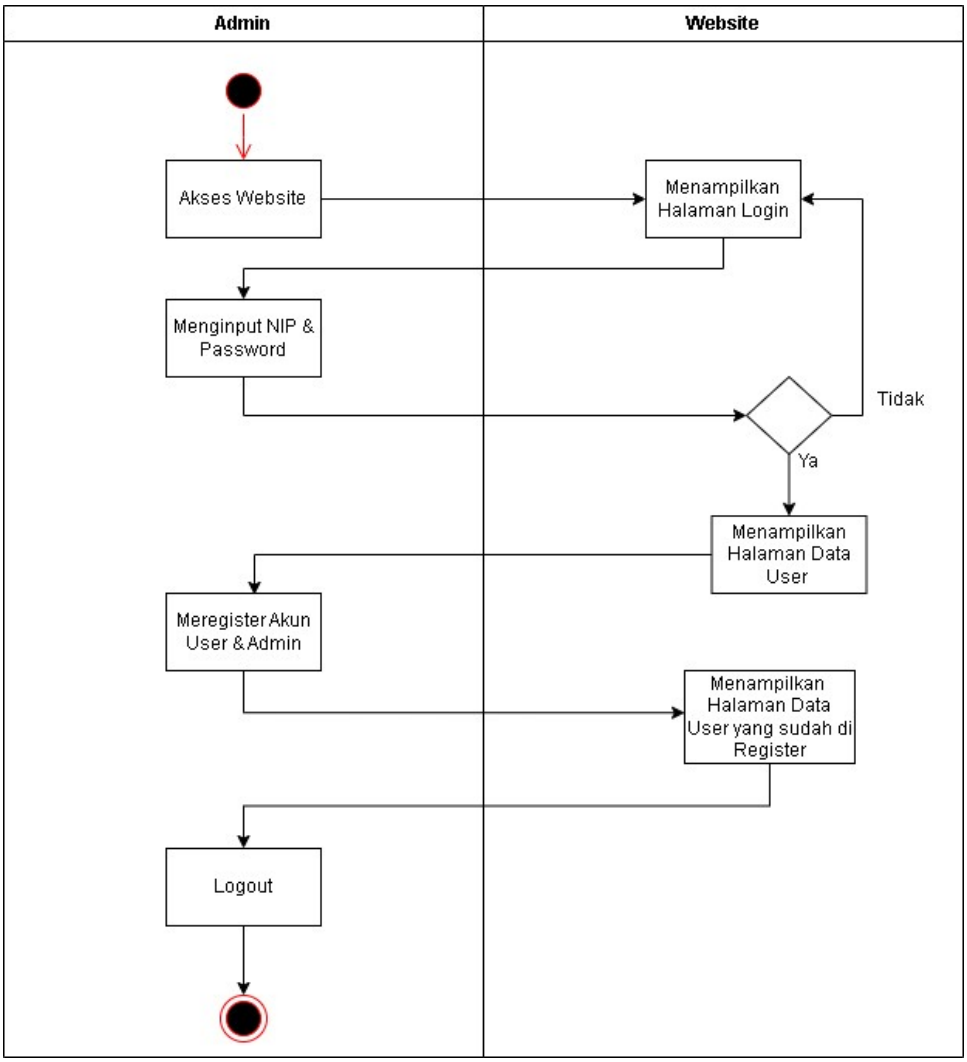

Figure 5: Activity diagram admin.

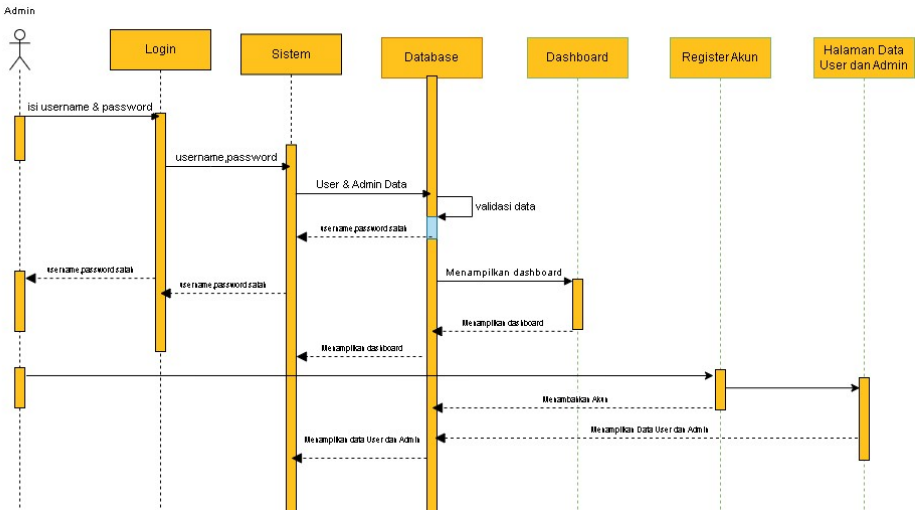

Figure 6: Sequence diagram admin.

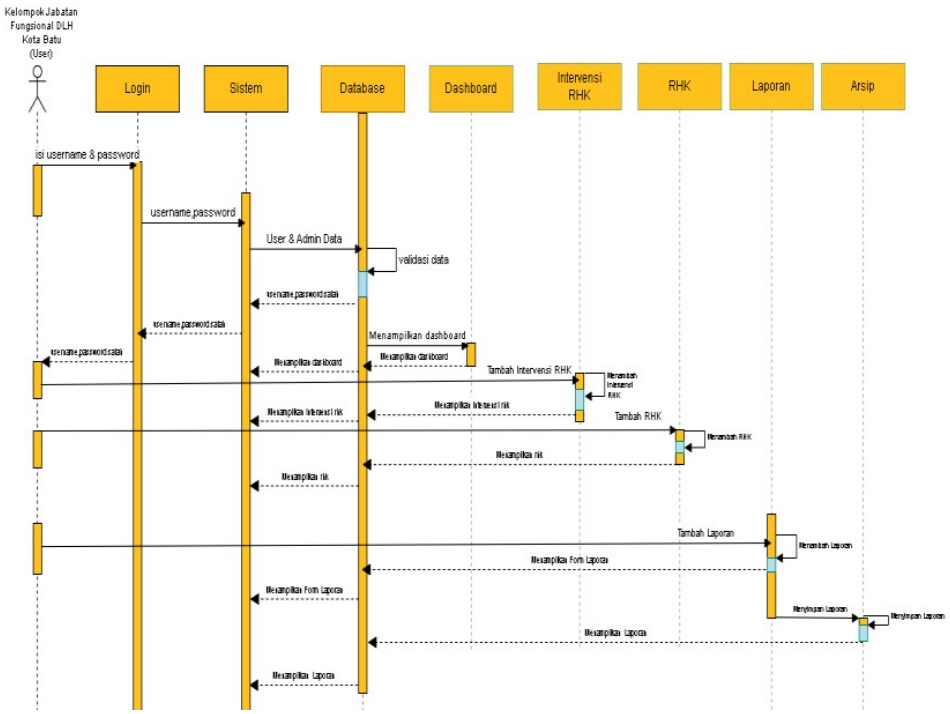

Figure 7: Sequence diagram user.

4.2. Sprint

The Sprint stage is divided into two sessions: sprint planning and sprint backlog. In sprint planning, the scrum team discusses determining the features built at the sprint stage. Then, in the sprint backlog, the development team determines the list of features determined during sprint planning. After the specified time is complete, it will continue with the next sprint. In developing this system, the development team sprinted three times.

4.2.1. Sprint I

The first sprint plans to create a login page and feature, a dashboard page, sidebar features, display headers and footers, and logout features from the account. The Sprint Backlog of the first sprint can be seen in Table 2.

The following are the results of the SMART PEKAN system display made at the Sprint I stage.

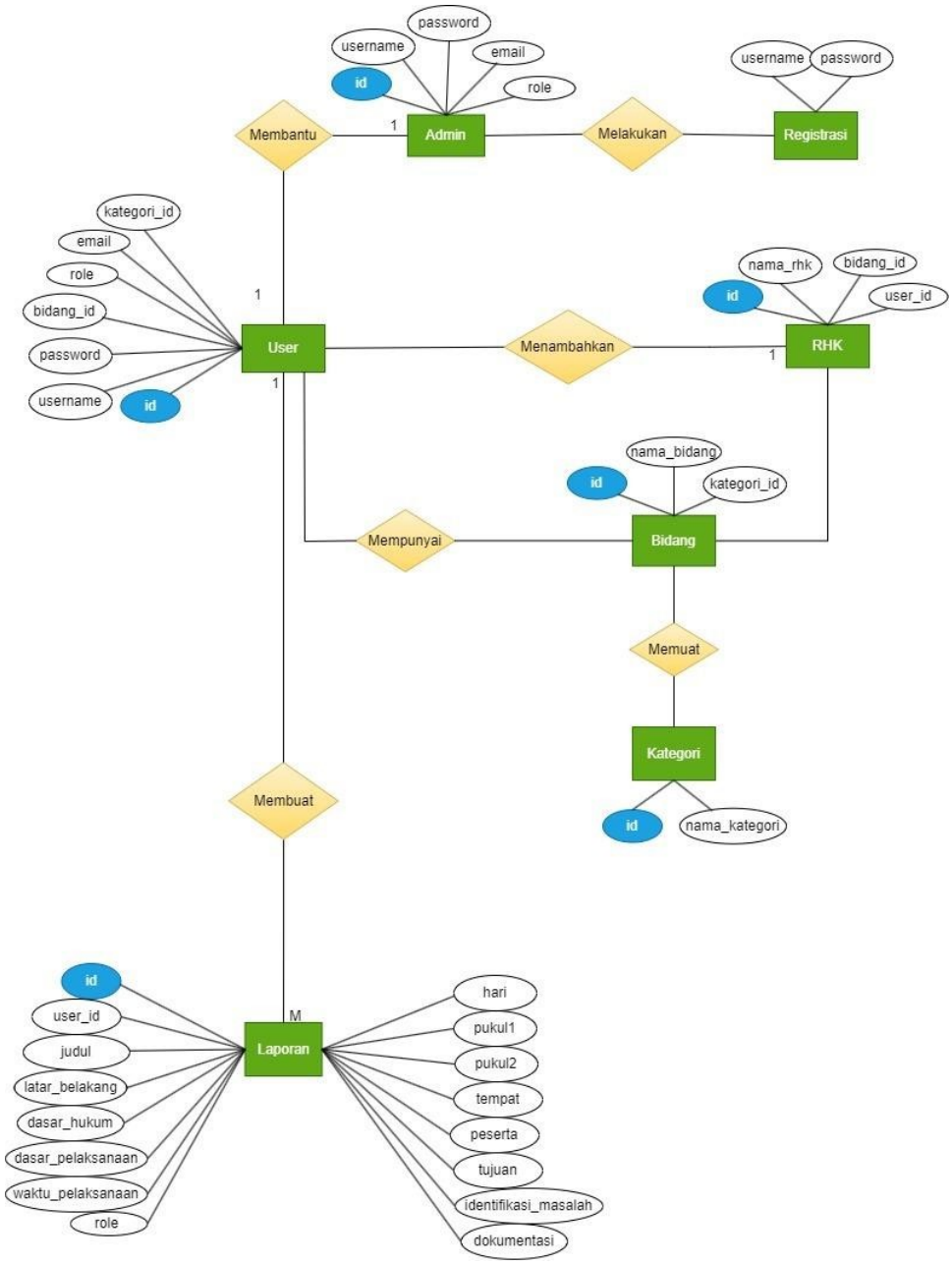

Figure 8: E.R.D.

4.2.2. Sprint II

The second sprint plans to create an admin dashboard page, a register page, and an administrator page. The Sprint Backlog at this stage can be seen in Table 3.

The following are the results of the SMART PEKAN system display made at the Sprint II stage.

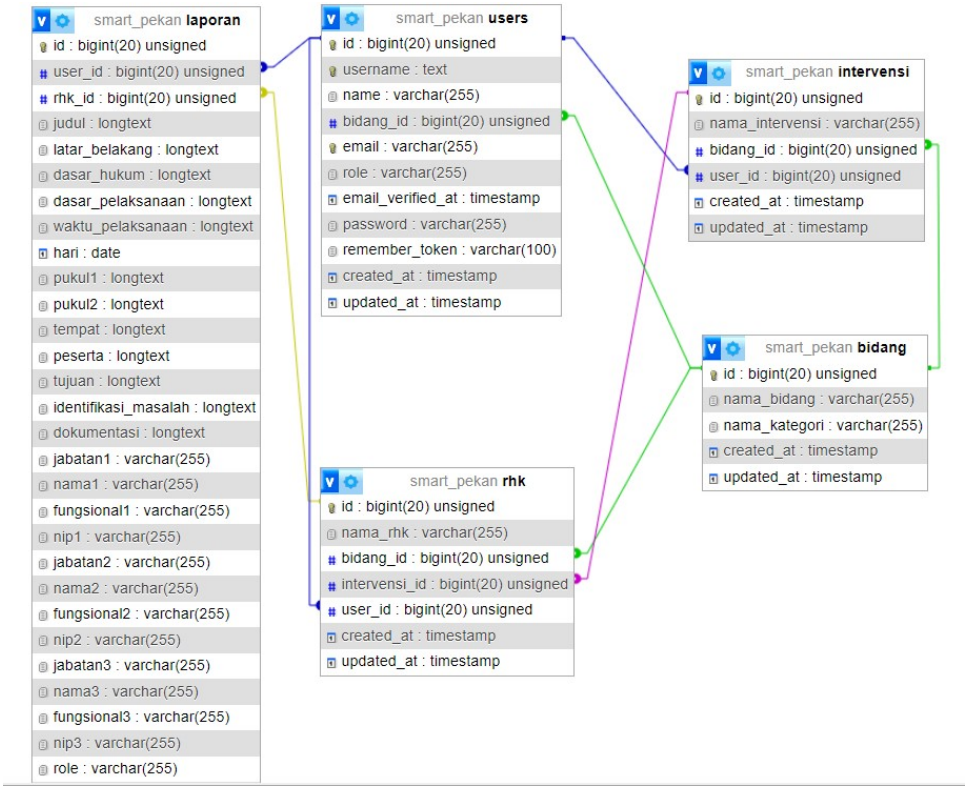

Figure 9: L.R.S.

TABLE 2: Sprint backlog 1.

No.	Sprint Backlog	Description	Priority
1	Login Page	System login page by entering a combination of username and password	High
2	Dashboard Page	Pages that show an overview of the data	High
3	Sidebar	List of vertical links in the left pane of the web for easy navigation to other pages	High
4	Header	The main icon at the top of the system is the branding	High
5	Footer	The content section at the very bottom of the web contains a copyright notice.	High
6	Logout Feature	Features that allow users to terminate system access	High

4.2.3. Sprint III

Plan from the third sprint to create archive, report, and R.H.K. pages. The Sprint Backlog at this stage can be seen in Table 4.

The following are the results of the SMART PEKAN system display made at the Sprint III stage.

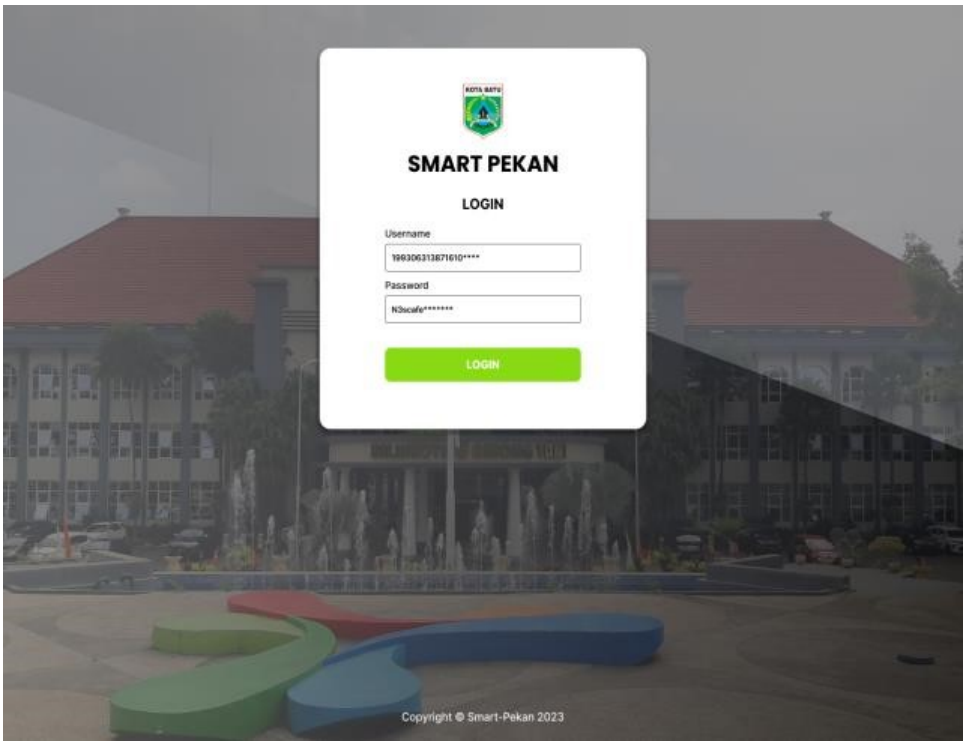

Figure 10: Login page.

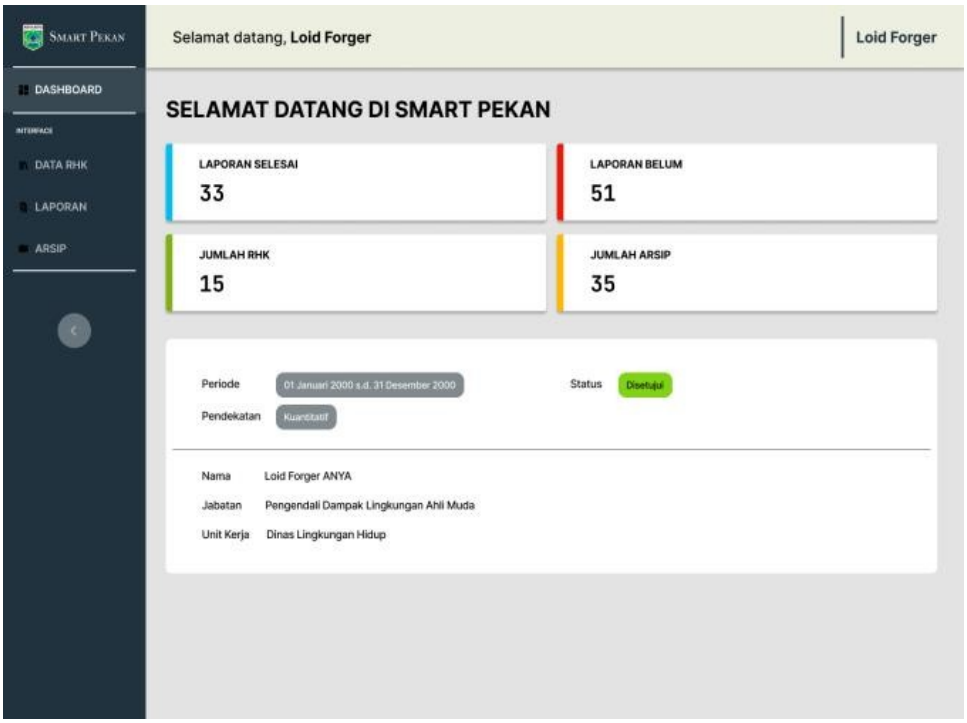

Figure 11: Dashboard.

TABLE 3: Sprint backlog 2.

No.	Sprint Backlog	Description	Priority
1	*Dashboard* Admin Page	Admin page that displays viewing all user data	High
2	*Register* Page	Pages where admins create user accounts or add users	High
3	Data Administrator (CRUD) Page	Page adds, views, edits, and removes users or admins	High

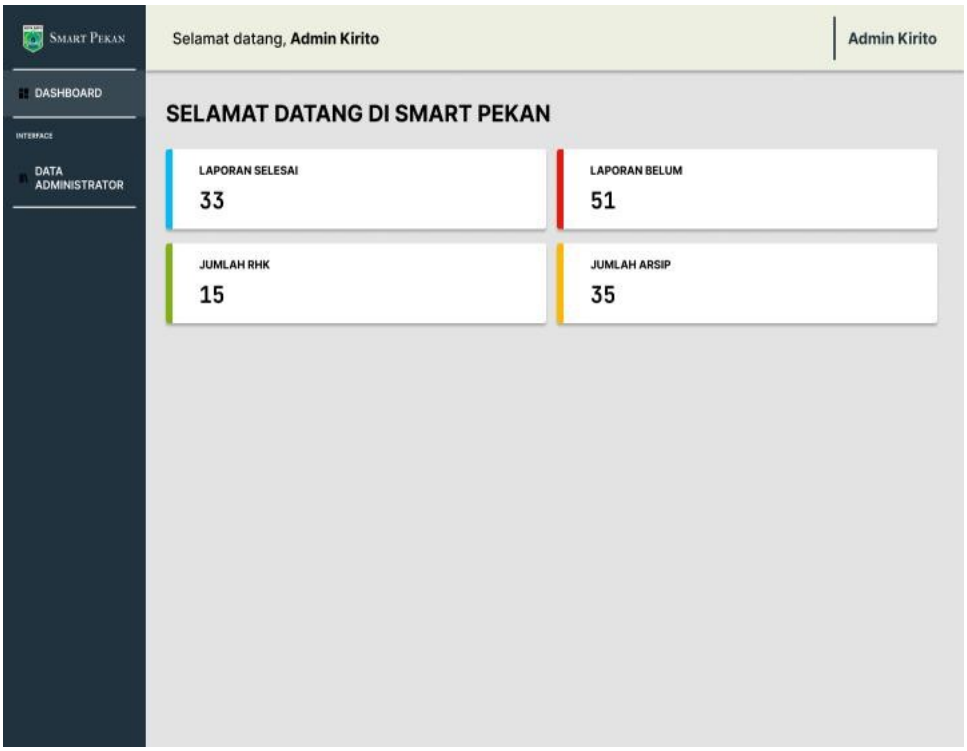

Figure 12: Dashboard admin.

TABLE 4: Sprint backlog 3.

No.	Sprint Backlog	Description	Priority
1	Archives Page	A page that contains a set of completed or incomplete reports. It contains features for deleting, editing, printing, and downloading reports.	High
2	Report Page	Pages for creating activity reports include features to customize the appearance of the report and add images.	High
3	Page R.H.K.	Pages for creating activity reports include features to customize the appearance of the report and add images.	High

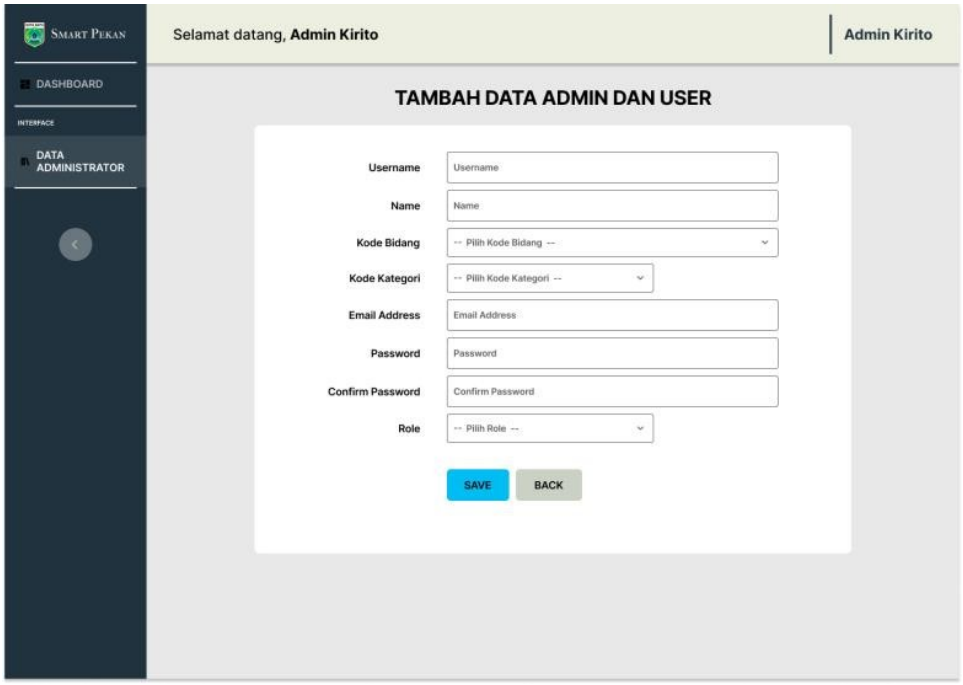

Figure 13: Register page.

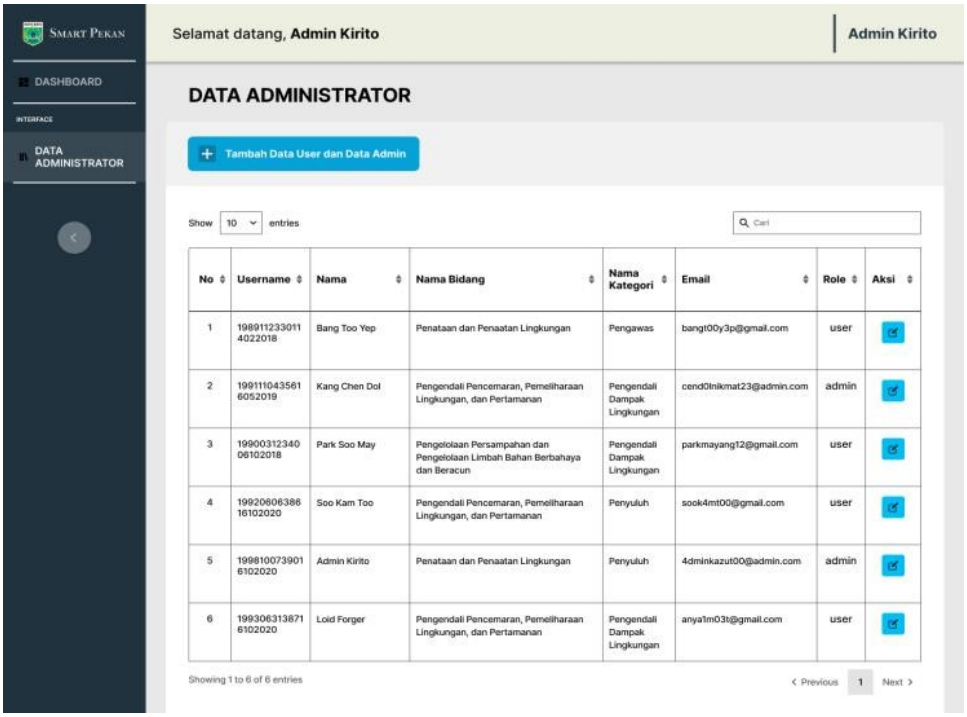

Figure 14: Data administrator.

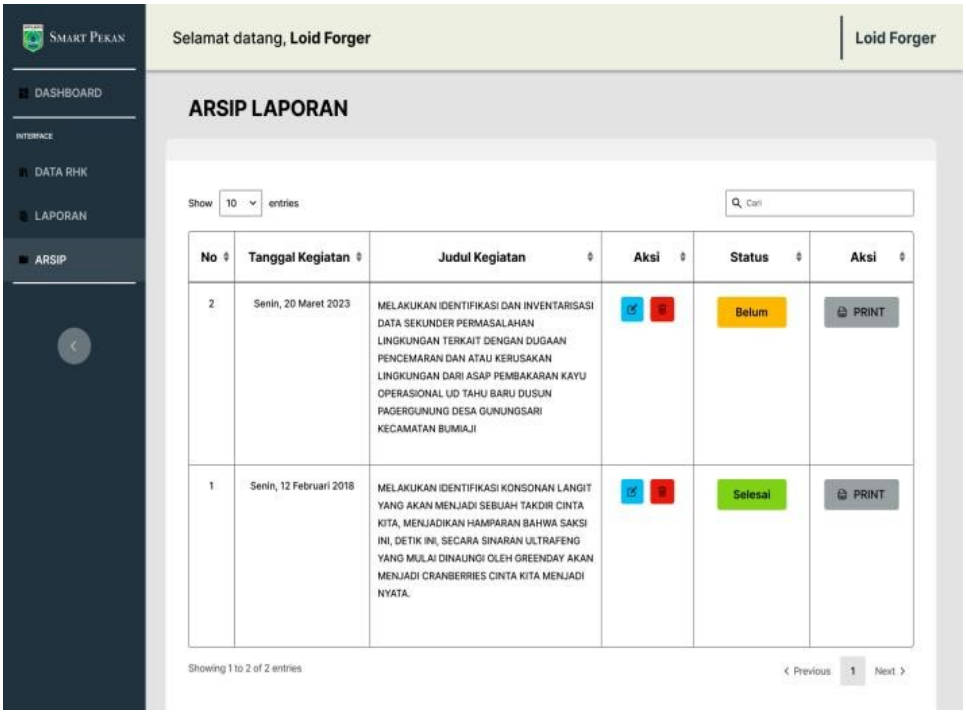

Figure 15: Archives page.

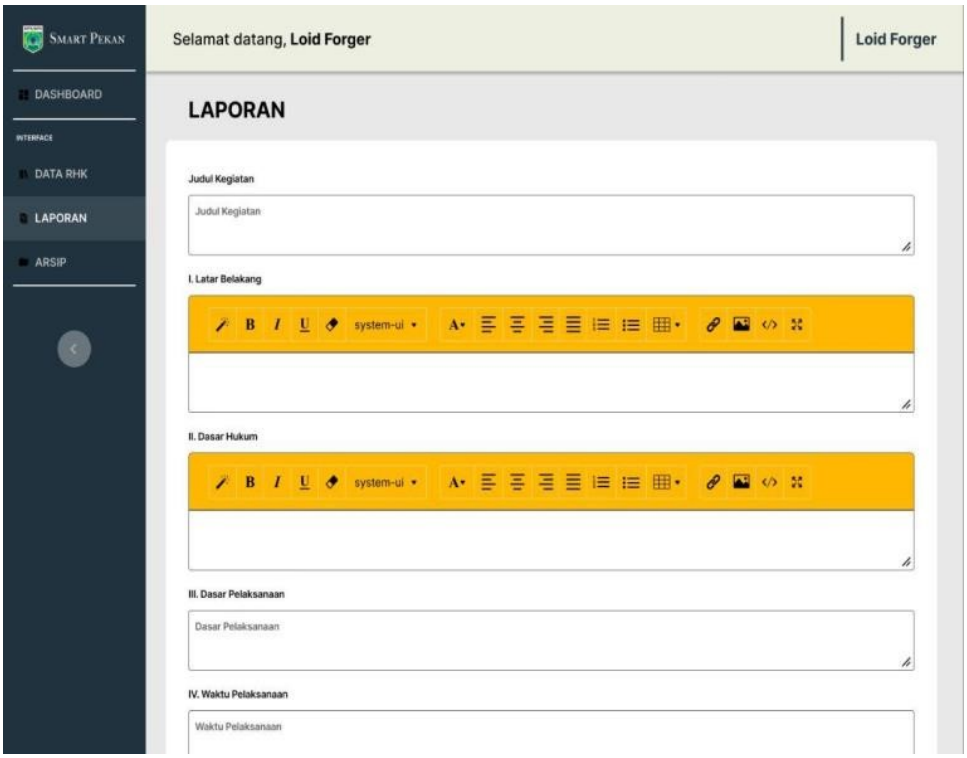

Figure 16: Reports page.

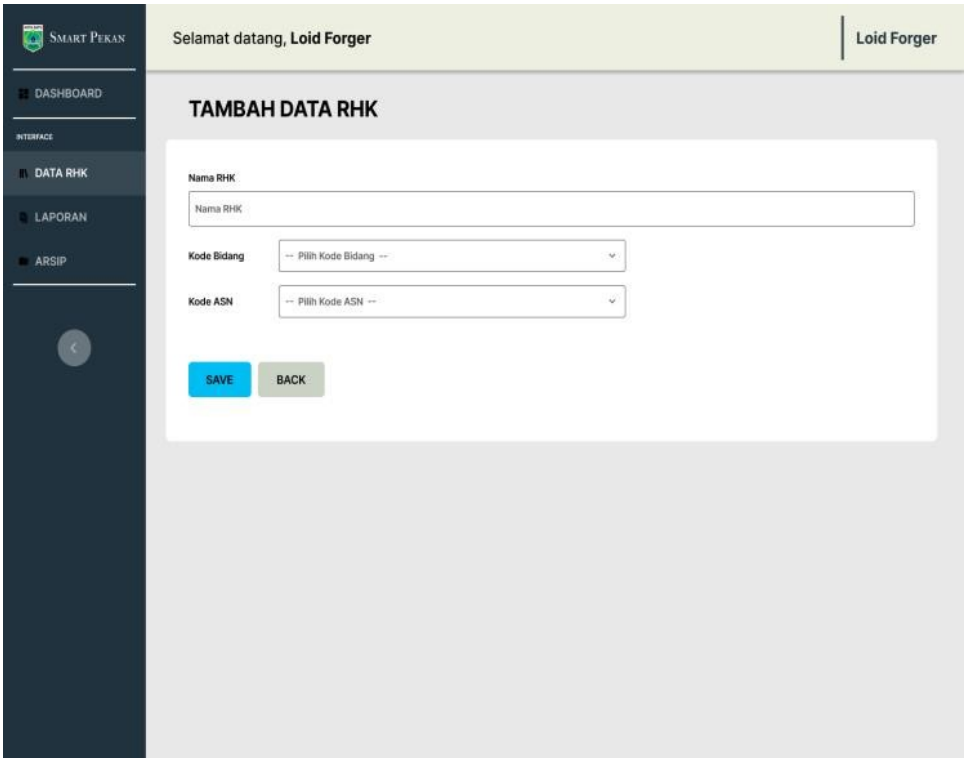

Figure 17: R.H.K. page.

4.2.4. Sprint IV

The fourth sprint plans to add create, read, update, and delete features to the R.H.K. Archives, Reports, and Data page. The Sprint Backlog at this stage can be seen in Table 5.

TABLE 5: Sprint backlog 4.

No.	Sprint Backlog	Description	Priority
1	Create Feature	Features to create or add information	High
2	Read Feature	Features to view or access information on the page	High
3	Edit Feature	Features to change data or information	High
4	Delete Feature	Features to delete data	High

4.2.5. Sprint V

The fifth sprint plans to create a report generation page along with CRUD features, adding PDF, photo input, and print features. The Sprint Backlog at this stage can be seen in Table 6.

TABLE 6: Sprint backlog 5.

No.	Sprint Backlog	Description	Priority
1	Data Intervensi + CRUD Page	R.H.K. Intervention page with features to view, add, edit, and delete R.H.K. Intervention	High
2	PDF Feature	Features that make reports PDF format	High
3	Download Feature	Feature to download reports	High
4	Insert picture Feature	Feature to include photos in reports	High
5	Print Feature	Feature to print reports in physical form	High

The following results are from the display of the SMART PEKAN system made at the Sprint V stage.

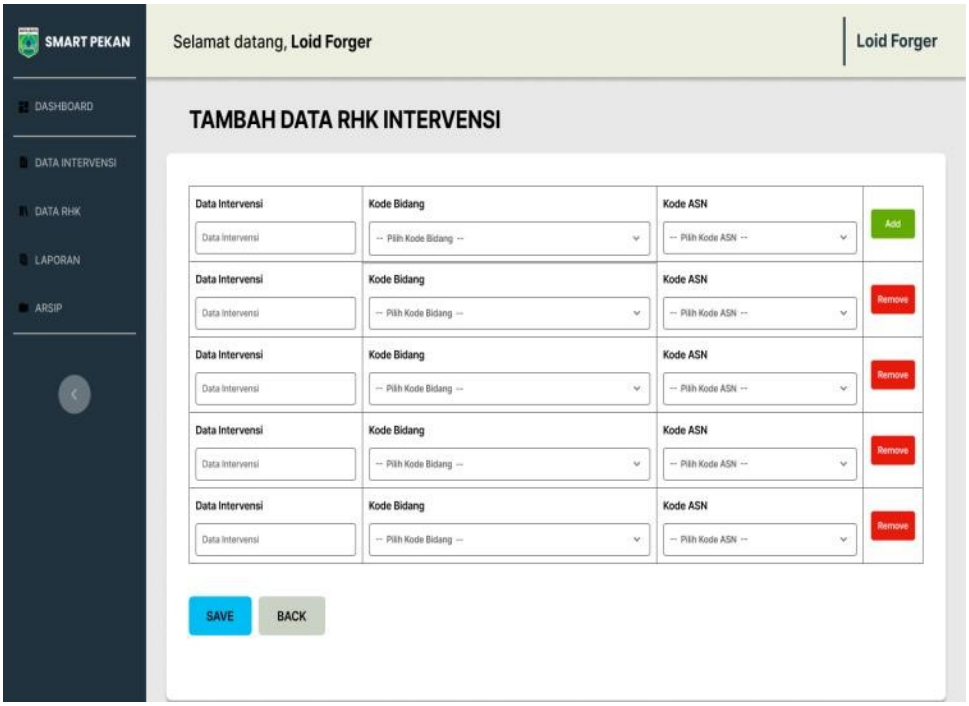

Figure 18: Intervention data page and CRUD feature.

4.3. Sprint review

The development of SMART PEKAN is carried out for five sprints within five weeks, with each sprint for one week. Of the 25 product backlogs submitted, 20 product backlogs have been worked on. The backlog product chosen to be worked on first is M.V.P., the basic features of SMART PEKAN, so it becomes a priority. During the development of

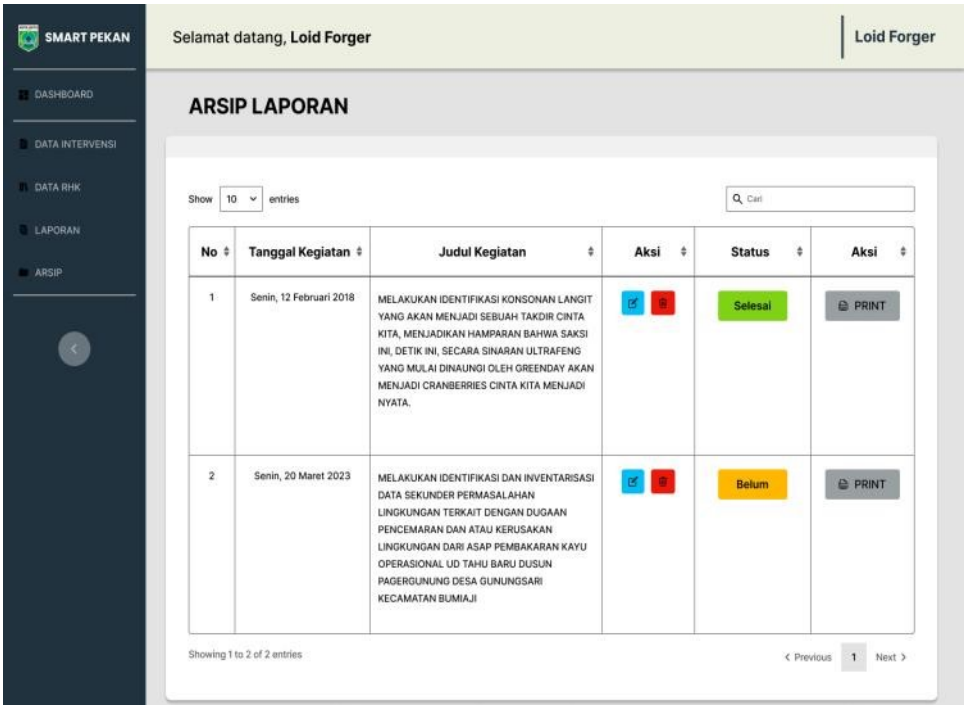

Figure 19: Archive page.

the system in each Sprint, a demonstration was carried out at the end of the sprint session; based on the discussion, the results of the review were obtained, including:

1. The sprint backlog was successfully created within a specified period
2. All page views were successfully created as planned
3. All features work with Baik
4. Some adjustments to the product backlog are needed to meet user needs

When Sprint IV was completed, revisions were made to the product backlog to add the Intervention Data Page and a feature to print reports through the printer. The decision is based on requests and changes in stakeholder needs. After Sprint V added the R.H.K. Intervention page and print feature to the sprint backlog. After performing five sprints, the M.V.P. of the system has been completed.

4.4. Sprint retrospective

The development process of SMART PEKAN by the scrum team went quite well. Team member collaboration goes well even though members come from different fields. Mentors also provide input that helps in the work on this project. A small number of members can make work faster. In addition, as a stakeholder, the Batu City Environmental Office

was quite satisfied with the results of the team's work when the demonstration was carried out.

The work on this project also has some shortcomings. Several problems caused the work to take longer than expected. There are some changes to the requirements, such as changes to function and data requirements. Scrum teams need to be more responsive and quickly adapt to face changes in a short time. In addition, the team needs to hold more meetings for member meetings to make work more organized. All team members must be involved in meetings and work on their responsibilities.

4.5. Discussion

To effectively discuss the implementation of Agile Scrum methodology in the development of local government, it is crucial to consider the challenges, success factors, and best practices associated with this approach. The literature provides valuable insights into the implementation of Agile Scrum in various organizational settings. For instance, [12] discuss the practices, challenges, and success factors in scaling Agile in large organizations, providing guidance for action research within software companies [19]. This study offers valuable insights into the challenges and strategies for effectively utilizing Agile Scrum in diverse organizational contexts.

Furthermore, the study by [2] provides a framework for the effective utilization of distributed Scrum in software projects, consolidating the results into a research framework [2]. This framework can be valuable in understanding how Agile Scrum can be effectively utilized in distributed environments, which is relevant to the context of local government development. Moreover, the literature emphasizes the need for tailored Agile methodologies to suit the unique culture and best practices of organizations. highlight the importance of implementing a blended Scrum model that integrates an organization's unique culture and best practices with Agile methodologies. This suggests that a one-size-fits-all approach may not be suitable for implementing Agile Scrum in the local government context, and customization based on the specific needs of the government is crucial. Additionally, the literature underscores the significance of understanding the factors contributing to successful Agile Scrum adoption [17]. Identifying factors that significantly contribute to Scrum adoption is crucial for the successful implementation of Agile methodologies in the local government context.

The development of SMART PEKAN website products using the scrum framework is considered more effective and efficient. The work is carried out with a duration of

about one month which has five sprint periods. Work specialization can be done well so that there is an orientation to achieving goals in each sprint period carried out. Each member of the scrum team can assess and evaluate the results of the team's work before validation with business partners.

The Smart Pekan website was designed by a team with the expected output to assist the performance of Batu City Environmental Office officials in making reports, both daily activity reports and official travel reports. This website is designed based on the needs of partners, namely the Environmental Agency which has been compiled in the product backlog which is then followed up by the scrum team through a sprint process.

5. Conclusion

SMART PEKAN is a web-based system developed using the agile scrum method. SMART PEKAN has basic features that are useful in making activity reports. Making activity reports using SMART PEKAN can help facilitate reporting of the Functional Position Group of the Batu City Environmental Office in preparing activity reports. System development by applying the agile scrum method makes the development process faster. SMART PEKAN can make making activity reports more accessible and more efficient.

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