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Development of a Web-Based Classroom Reservation System Using the Agile Scrum Methodology

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Abstract

GoClass is a web-based application designed to simplify the classroom reservation process in higher education institutions. This study aims to design and implement a system that supports efficient scheduling, approval, and analysis of classroom usage. The system development follows the Agile Scrum methodology, which emphasizes team collaboration, short development iterations (sprints), and continuous user feedback, involving stages such as sprint planning, daily stand-ups, sprint reviews, and sprint retrospectives. Unified Modeling Language (UML) diagrams—including use case, activity, and Class Diagram—were used to model system functionality and data flow. The main features developed include user authentication, real-time notifications, and room recommendations based on availability and capacity. The system also features an interactive dashboard that visualizes room usage trends, supporting data-driven decision-making.

Keywords: Classroom Reservation System, Web-Based Application, Agile Scrum

I. INTRODUCTION

The development of information and communication technology in the last two decades has brought fundamental changes in various sectors of life, including in the industrial and business world [1]. With the advancement of technology in the current era, technology is increasingly making everyday human life easier. The purpose or intent of this technological development is to assist the general public in addressing existing problems. [2]. The procedure for room reservations that is carried out manually still has many limitations, such as the occurrence of human errors in scheduling room usage, which can lead to time conflicts in room bookings [3]. Typically, borrowing involves items, money, or even documents that are governed by an agreement with certain terms to ensure that the borrowed items, money, or documents are returned properly and on time.[4]. The process of room booking is still done using conventional methods, namely by submitting a letter directly to the relevant staff. This can result in the letter being lost. Another issue is that borrowers are unaware of whether the room has already been booked by someone else at the desired date and time.
[5]. From the room and equipment borrowing process described above, several issues have been identified. First, there is no clear information regarding the submission of the request letter by students, which results in students having to wait up to three days to receive confirmation of their booking.[6].

Over the past few decades, the software development field has witnessed the introduction of numerous methodologies, many of which have failed to gain lasting traction in practice. Traditional information systems (IS) development methods, though once dominant, have been increasingly criticized for being overly rigid and symbolic rather than practically useful.Scholar s such as Nandhakumar and Avison (1999), Parnas and Clements (1986), and Truex et al. (2000) have all questioned the relevance and applicability of these conventional approaches in real-world settings. In response to these limitations, a new wave of methodologies—collectively referred to as *agile software development methods*—has emerged, aiming to provide more flexible and adaptive alternatives. [7].Given the urgency and relevance of the aforementioned issues, the development of a web-based room reservation information system is crucial. This system can enhance operational efficiency, reduce the risk of human error, and support a more organized and transparent room management process within the institution. [8].

Common issues in conventional room reservation systems include lost reservation letters, unclear room availability information, and the lack of a digitally documented booking history. For instance, the Faculty of Information Technology and Data Science at Universitas Sebelas Maret has faced such challenges, prompting the development of an integrated and efficient web-based system. [9]. A system is a unified set of elements that are interconnected and influence one another, working together to achieve a specific goal. A system consists of various components that are organized and interact as an integrated whole. The objective of the system can be achieved by processing inputs, which are then transformed (processed) into outputs. A system has a feedback mechanism to monitor and regulate its performance in order to achieve the desired goal. , [10].

II. LITERATURE REVIEW

The development of information technology has had a significant impact on the efficiency and effectiveness of data management and administrative services. This has driven many institutions to abandon manual systems, which are often slow and prone to errors. Conventional room borrowing systems, such as using physical request letters, are no longer considered relevant due to various issues, such as lost documents, lack of real-time room availability information, and the absence of a well-organized documentation system. Therefore, a web-based information system solution is needed to provide more flexible access and more accurate data management, including features such as borrowing history, automatic notifications, and real-time room availability monitoring.[11] In the development process of this information system, the Agile Scrum methodology is the appropriate approach due to its iterative nature and flexibility in adapting to changes in user requirements. Agile Scrum enables development teams to collaborate effectively and quickly respond to feedback through phases such as Sprint, Daily Scrum, Sprint Review, and Sprint Retrospective. By implementing this method, system

development can be carried out in incremental and measurable steps, ensuring that the final product better meets user needs while minimizing the risk of project development failure.[12] In addition, the integration of visual technologies such as interactive maps and 360-degree panoramic images within the information system also becomes an innovation that can enhance the user experience. Several studies have shown that this approach is effective in providing a visual representation of room locations and conditions in real-time, making it easier for borrowers to make informed decisions. The combination of a web-based system, Agile Scrum development methodology, and interactive visual elements forms a strong foundation for creating a room reservation system that is efficient, informative, and responsive to the needs of both users and institutions..[13] Combining a web-based system, Agile Scrum methodology, and interactive visual elements lays a solid foundation for an efficient, informative, and user-responsive room reservation system.[14]Thus, the developed room reservation system not only meets functional requirements but also provides a more intuitive user experience and adapts to the dynamic environment of the institution.]Testing web-based information systems is essential to ensure their reliability and functionality. The Equivalence Partitioning (EP) technique in black-box testing divides inputs into valid and invalid groups to improve testing efficiency. The focus is generally on critical features such as login, using various input combinations, including boundary conditions. The goal is to ensure the system processes valid inputs correctly, rejects invalid ones, and maintains user security and convenience. EP can also serve as a basis for further testing to enhance system quality.[15]

III. RESEARCH METHOD

The development of information technology has encouraged many software development teams to abandon traditional, rigid methodologies that are less responsive to change, and switch to the more flexible and adaptive **Agile Scrum** method. Several studies have shown that the adoption of Agile Scrum has a significant impact on improving team collaboration, product delivery speed, and better quality outcomes through faster iterations and more intensive involvement with stakeholders[1].

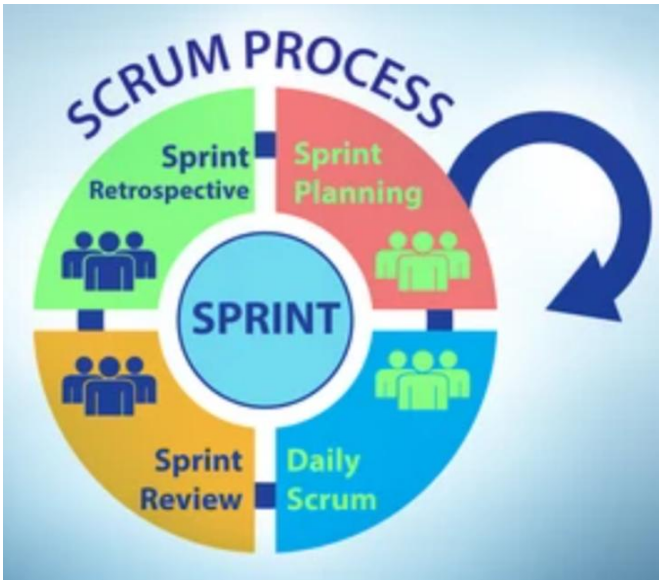

fig 1. Agile scrum Method
Source: [5]

The following are the stages of the agile scrum method:

A. *Sprint Planning*: This is a meeting to plan the work for the sprint. It is the initial phase in each sprint cycle in the Agile Scrum methodology, where the entire Scrum team—comprising the Product Owner, Scrum Master, and Development Team—gathers to determine what will be worked on during the sprint. The objective of sprint planning is to agree on the sprint goal and select the highest-priority items from the product backlog to be developed into the sprint backlog
B. *Sprint Backlog & Execution* Is a Sprint Backlog lists selected tasks from the Product Backlog to be completed in a Sprint. In Sprint 2 of the GOCLASS system, the focus is on the student room reservation feature and admin verification.
C. *Daily Scrum* is a short daily meeting (lasting no more than 15 minutes) held every day during the sprint in the Agile Scrum methodology. This meeting is attended by the entire Development Team and is facilitated by the Scrum Master if necessary, but the Scrum Master does not lead the discussion. The main purpose of the Daily Scrum is to synchronize the team's work, identify obstacles, and plan daily activities to stay aligned with the sprint goal.
D. *Sprint Review* is a meeting held at the end of each sprint within the Agile Scrum framework to present the team's work results to the Product Owner and stakeholders. The purpose of the sprint review is to evaluate the increment—i.e., the portion of the product that has been completed during the sprint—and to gather direct feedback from relevant parties to determine whether the work meets the requirements or needs adjustment.
E. *Sprint Retrospective* is a meeting held after the Sprint Review and before the next Sprint Planning in the Agile Scrum methodology. The primary purpose of the Sprint Retrospective is to evaluate the team's work process during the completed sprint, identify what went well, what needs improvement, and determine how to enhance the team's performance in the next sprint.

IV. RESULTS AND DISCUSSION

This section comprehensively presents the results from the design stage to the implementation of the web-based GoClass room reservation system developed using the Agile Scrum approach. Each development phase is analyzed based on actual achievements, covering aspects of system functionality, user experience, and room availability validation mechanisms to prevent booking conflicts.

A. Sprint Planning

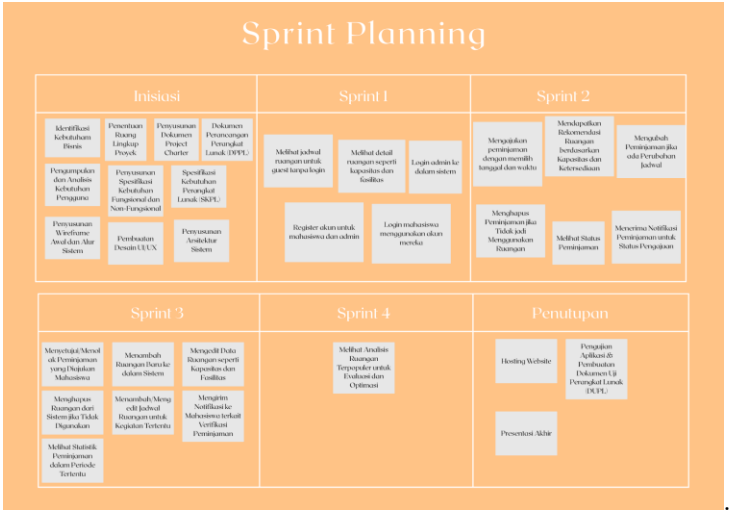

fig. 2. Sprint Planning

Sprint Planning is a meeting held at the beginning of each sprint to plan the work that will be done during that sprint period. The main goal of Sprint Planning is to determine which items from the Product Backlog will be worked on and to plan the necessary steps to complete those tasks. The team will discuss available capacity, set sprint goals, and break down backlog items into smaller, manageable tasks.

1. Use Case Diagram

The *GoClass System* use case outlines how users and admins interact with the system to manage academic activities. Users take attendance, access materials, and track progress, while the system stores data and generates reports. Admins manage users, verify attendance, and oversee academic records. Key scenarios include attendance tracking, class management, material distribution, and report generation.

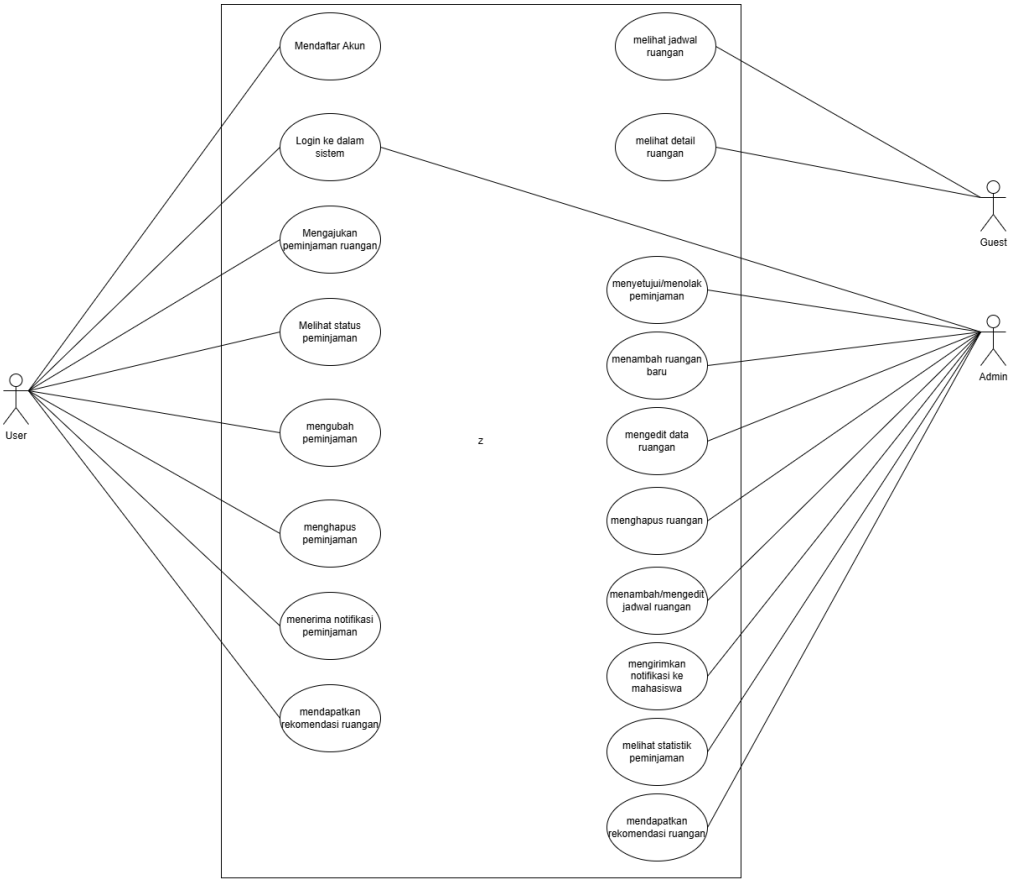

fig. 3 Use Case Diagram

2. Class Diagram

Class Diagram illustrates the database structure of the GoClass room booking system. There are four main entities: t_mahasiswa (student data), t_dosen (lecturer as validator), t_ruangan (room availability), and t_peminjaman (booking transactions). The t_peminjaman table serves as the central relationship hub, connecting to students who make bookings, rooms being booked, and lecturers who approve requests. The system is designed to facilitate digital room reservations with status tracking (Pending/Approved/Rejected), while ensuring data integrity through constraints like unique student

NIMs and positive room capacity values. GPS and time validation can be added to verify that bookings are made within authorized periods and locations.

1. **Lecturer - Student:**
   One lecturer can supervise many students, and one student can have at most one lecturer.
2. **Student - Borrowing:**
   One student can make many borrowings, but one borrowing can only be made by one student.
3. **Borrowing - Room:**
   One room can be borrowed multiple times, but one borrowing is only for one room.

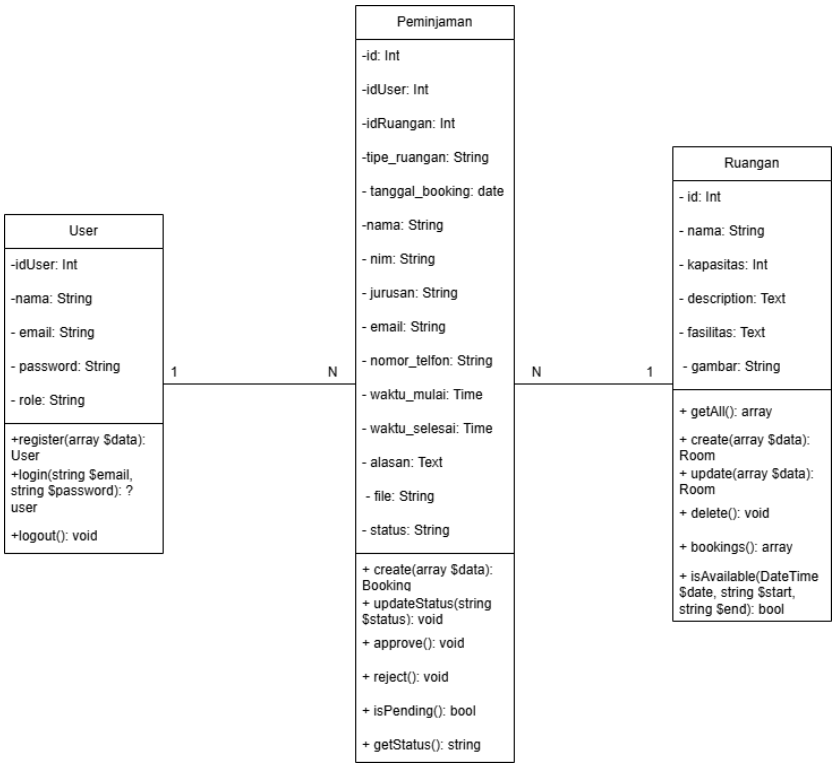

fig. 4. Class Diagram

B. Sprint Backlog & Execution

The team has demonstrated strong collaboration with clear task allocation and adherence to the planned timeline. This structured approach ensures we continue progressing toward completing a fully functional room booking system that meets user needs.

TABLE I

Sprint Backlog

PBI	Task	Responsibilities	Estimated Hours	Status
DPPL.GC.006	Create submission form	Ilham	4 Hour	in progres

	Validate time & input	Ilham	3 Hour	Done
	Save to DB & backend connection	Rafi	6 Hour	in progres
	Test submission	Gandi	4 Hour	in progres
DPPL.GC.007	Display borrowing status	Rafi	5 Hour	in progres
	Test display status	Gandi	3 Hour	in progres
DPPL.GC.012	Admin validation form	Ilham	4 Hour	in progres
	Approval logic (backend)	Rafi	6 Hour	in progres
	Test approval	Gandi	6 Hour	in progres
DPPL.GC.017	Create status notifications	Rafi	8 Hour	in progres
	Trigger notifications	Rafi	4 Hour	in progres

C. Daily Scrum

The Daily Scrum is a brief 15-minute meeting that takes place every day during the sprint, with all team members in attendance. The main objective of this meeting is to assess the daily progress, ensure alignment of tasks, and detect any obstacles or challenges as early as possible. Each team member answers three important questions:

1. What did I do yesterday?
2. What will I do today?
3. Are there any impediments in my way?

This helps the team stay on track, promotes accountability, and allows for quick identification of any issues that need to be addressed to keep the sprint on schedule.

TABLE 2

Daily Scrum

Day	Name	Yesterday	Today	Impediments
Day 3	Ilham	Completed HTML form	Time validation	Needs reference for time logic
Day 3	Rafi	Submission Endpoint	Save to DB	Conflict validation not optimal yet
Day 4	Gandi	Submission Test	Test empty validation	UI error handling
Day 6	Ilham	Admin form validation	Layout completed	No issues
Day 7	Rafi	Logic update status	Update status logic	Trigger not stable yet
Day 9	Semua	Final Testing	Sprint Review	No issues

D. Sprint Review

fig. 5. Main Website Display and Number of People Display

This figure shows the main display of the rental website, where users are asked to select a rental date. The interface features an interactive calendar that allows users to choose available dates, marked in green. This feature facilitates users in determining the appropriate rental period. and this figure displays the page for inputting the number of people who will use the room. Users are prompted to enter a number according to their capacity needs. The "Next" button directs users to the next input step. This page is intended to manage room capacity to avoid exceeding the maximum limit

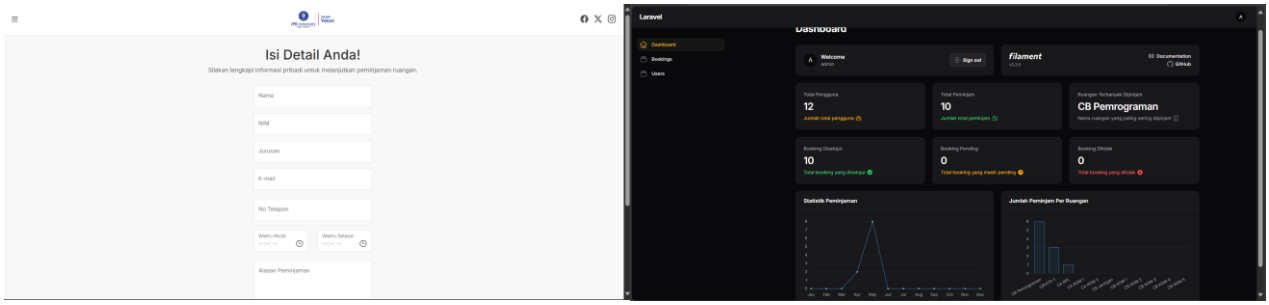

fig. 6. Detail Input Display and Admin Dashboard Display

This figure shows a form where users are required to fill in their personal information, such as name, number of people, phone number, email, and rental date. This form serves as the final step in the reservation process and aims to collect complete user data before the rental is confirmed. and this figure displays the admin dashboard interface, which provides an overview of key data related to system usage. It includes information such as total registered users, total completed bookings, and most frequently booked rooms. Additionally, graphical visualizations show booking statistics over time and the number of bookings per room.

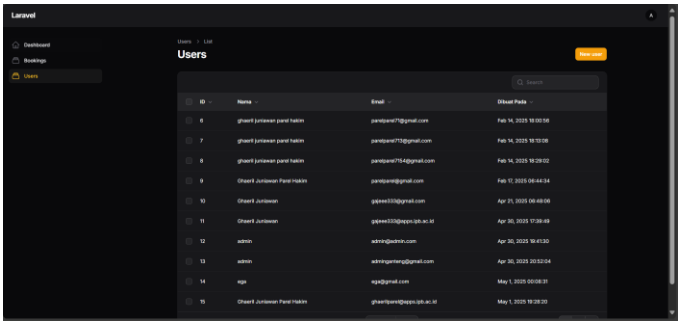

fig. 7. User Dashboard Display

This figure shows the user management interface, where administrators can view a list of all registered users. The table includes columns for user name, email, and registration date. It also provides options for managing or editing user information. This display helps in organizing user data and performing administrative tasks related to user accounts.

Sprint	Task	Bobot (%)	Progress (%)	Penanggung Jawab	Status
	Identifikasi Kebutuhan Bisnis	2	100%	Ilham	Complete
	Penentuan Ruang Lingkup Proyek	2	100%	Ilham	Complete
	Penyusunan Dokumen Project Charter	2	100%	Ilham	Complete
	Pengumpulan dan Analisis Kebutuhan Pengguna	2	100%	Ilham	Complete
	Penyusunan Spesifikasi Kebutuhan Fungsional dan Non-Fungsional	2	100%	Ilham	Complete
	Spesifikasi Kebutuhan Perangkat Lunak (SKPL)	3	100%	Ilham	Complete
	Penyusunan Wireframe Awal dan Alur Sistem	2	100%	Ghaeril	Complete
	Pembuatan Desain UI/UX	2	100%	Rafi	Complete
	Penyusunan Arsitektur Sistem	2	100%	Ghaeril	Complete
	Dokumen Perancangan Perangkat Lunak (DPPL)	3	100%	Ilham	Complete
Inisiasi	**Total**	**22**	**100%**		
	Melihat Jadwal Ruangan untuk guest tanpa login	3	100%	Rafi	Complete
	Melihat Detail Ruangan seperti kapasitas dan fasilitas	3	100%	Rafi	Complete
	Register Akun untuk mahasiswa dan admin	4	100%	Ghaeril	Complete
	Login mahasiswa menggunakan akun mereka	3	100%	Ghaeril	Complete
	Login Admin ke dalam sistem	3	100%	Ghaeril	Complete
Sprint 1	**Total**	**16**	**100%**		
	Mengajukan Peminjaman dengan memilih tanggal dan waktu	4	100%	Ghaeril	Complete
	Melihat Status Peminjaman (Pending/Disetujui/Ditolak)	3	100%	Rafi	Complete
	Mengubah Peminjaman jika ada perubahan jadwal	3	100%	Ghaeril	Complete
	Menghapus Peminjaman jika tidak jadi menggunakan ruangan	3	100%	Ghaeril	Complete
	Menerima Notifikasi Peminjaman untuk status pengajuan	2	100%	Ghaeril	Complete
	Mendapatkan Rekomendasi Ruangan berdasarkan kapasitas dan ketersediaan	3	100%	Ghaeril	Complete
Sprint 2	**Total**	**18**	**100%**		
	Menyetujui/Menolak Peminjaman yang diajukan mahasiswa	4	100%	Ghaeril	Complete
	Menambah Ruangan Baru ke dalam sistem	3	100%	Ghaeril	Complete
	Mengedit Data Ruangan seperti kapasitas dan fasilitas	3	100%	Ghaeril	Complete
	Menghapus Ruangan dari sistem jika tidak digunakan	3	100%	Ghaeril	Complete
	Menambah/Mengedit Jadwal Ruangan untuk kegiatan tertentu	4	100%	Ghaeril	Complete
	Mengirimkan Notifikasi ke Mahasiswa terkait peminjaman	2	100%	Ghaeril	Complete
	Melihat Statistik Peminjaman dalam periode tertentu	5	100%	Rafi	Complete
Sprint 3	**Total**	**24**	**100%**		
	Melihat Analisis Ruangan Terpopuler untuk evaluasi dan optimasi	5	100%	Gandi	Complete
Sprint 4	**Total**	**5**	**100%**		
	Hosting Website	3	100%	Rafi	Complete
	Pengujian Aplikasi & Dokumen Uji Perangkat Lunak (DUPL)	4	100%	Gandi	Complete
	Presentasi Akhir	8	100%	Ilham	Complete
Penutupan	**Total**	**15**	**100%**		
Total Semua		**100**	**100.00%**		

fig. 8. User Dashboard Display

The document is a project progress report structured based on the Agile approach, with work divided into several sprints. This document is commonly referred to as a Sprint Project Progress Report or Sprint Progress Report. It contains various tasks that need to be completed in each sprint phase, starting from the initiation stage to the project closure. Each task has a specific weight percentage that indicates its contribution to the overall project.

V. Conclusion

In conclusion, the development of a web-based room reservation system offers a significant improvement over the conventional manual methods, addressing several issues such as document loss, lack of real-time room availability, and poor documentation. By leveraging Agile Scrum methodology, the system development process becomes more adaptive and responsive to changing user requirements, ensuring that the final product aligns with user needs. The integration of visual technologies such as interactive maps and 360-degree panoramic images further enhances the user experience, providing real-time, intuitive visual representations of room locations and conditions. This combination of a web-based platform, Agile Scrum, and visual elements forms a solid foundation for an efficient, informative, and user-centric room reservation system. Such an approach not only streamlines the room reservation process but also ensures better data management, increased transparency, and improved operational efficiency within the institution.

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