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SIAP YIA: AN AIRPORT PAVEMENT INFORMATION SYSTEM FOR AIRPORT PAVEMENT DATA STORAGE

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Abstract

The information system for storing pavement data at the airport remains manual and is currently focused on a single device. This study aims to design a website-based application for storing pavement data at the airport. With this application, it is expected to improve the service of the airport facilities unit. The data used in this study is pavement data from Yogyakarta International Airport. This study employs the Research and Development (R&D) method, utilizing the Waterfall model for the second stage, specifically the design stage, with planning tools that include flowcharts and use case diagrams. The design of this application also uses the App Sheet website using simple coding. Additionally, this application is compatible with various platforms, making it more flexible for use anywhere and at any time online. Of course, with this application, pavement data storage can be computerized properly, and it features a database that helps reduce the accumulation of documents and prevent the loss of documents in other files.

Keywords: *information system, pavement, technicians*

Introduction

An information system is a combination of information technology and human activities that use that technology to support operations and management (Novi, 2021). The rapid development of information systems requires organizations to be able to utilize this technology (Nelfira et al., 2020). Every series of organizational activities involves the exchange of information. In providing this information, a tool or media is needed to manage various data so that it can be presented as useful information, so that work becomes faster, more effective, and more efficient (Irawati, 2019). Every organization, whether in government, private, agency, or company, definitely needs a system (Wahyu et al., 2022). One of them is the airport, which has an important role in serving operations optimally, which of course must be equipped with adequate facilities and in the best condition, especially on the air side facilities (Suryan, Amalia, et al., 2023).

These airside facilities play an important role in flight safety and security, where airside facilities such as runways, taxiways, and aprons must be in the best condition at every airport operating, especially in pavement conditions (Suryan, et al., 2023). Both the pavement layer and the pavement surface, which are the most critical locations for aircraft during takeoff and landing, must be checked and maintained regularly to remain in the best condition (Afriyani & Suryan, 2022). Therefore, inspections, maintenance, and testing must be carried out on the pavement, in these activities will obtain data results that must be stored. This data storage is the role of information technology that greatly influences our ability to answer the demands of faster, more effective, and more efficient work (Husna, 2022).

In the context of airport facility management, information systems play a crucial role in managing technical data, including pavement inspections, maintenance results, and repair schedules, so that it can be accessed centrally, quickly, and accurately. Data recording on the airport facilities unit at Yogyakarta International Airport, in the form of inspection, maintenance, and testing data, is typically done on a laptop using Microsoft Excel or Microsoft Word by the Airside Technician or Airside Facilities Technician. The data storage is on a special PC for storing the airport airside data.

However, data storage like this has several disadvantages, such as the laptop memory being full, and also the possibility of data being lost at any time, or forgetting the storage location of the pavement data archive, Besides, the data is difficult to access anytime and anywhere (Ramsari et al., 2022). In addition, according to the results of the Airport Pavement Construction Maintenance Report, airside inspection results are reported via *WhatsApp* using a digital media serviceability inspection form. This form was initially filled in manually and then scanned and stored in digital media. This form of reporting certainly has disadvantages, such as data not being durable, which can easily expire, and also requires a large enough memory to store reports daily.

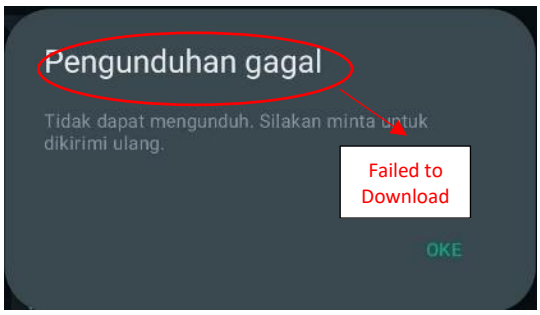

Figure 1. Expired File View On *Whatsapp*

This study aims to design a website-based application for storing pavement data at the airport. With this application, it is expected to improve the service of the airport facilities

unit. Research related to the development of information systems to support airport facility management is growing, along with the increasing need for digitalization of operational processes. In Indonesia, Kencana (2020) developed an Android-based application for recording pavement maintenance activities at Juanda Airport. The application utilizes a SQLite database and QR code-based validation to ensure data authenticity and integrity. A study by Septiani et al. (2024) on the development of runway defect detection tools highlights the importance of integrating hardware and software to support technical information systems in the airside area.

However, studies that specifically develop a user-friendly and lightweight application-based digital information system for pavement data documentation and archiving at regional airports, such as YIA (Airport Pavement Information System – Yogyakarta International Airport), are still limited. Therefore, the SIAP-YIA design addresses this gap by combining the R&D approach, the App-Sheet platform, and direct validation from technical users in the field.

Methods

This research uses the Research & Development (R&D) method with the Waterfall Model, which is an illustrative and sequential approach to software development, starting with user needs analysis, system design, software design, system implementation, and testing (Sansena, 2021). This research is limited to the second stage, namely the design stages, focusing on prototype design, which is the purpose of the product.

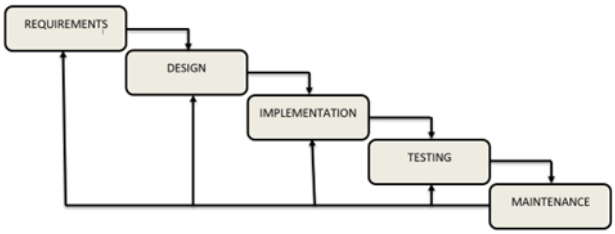

Figure 2. Waterfall Method

Based on the image above, the waterfall method consists of five stages; however, due to time constraints, this research only proceeds to the design stage. Research is conducted at Yogyakarta International Airport for 6 months, or during the On-the-Job Training (OJT) period. This research begins with a requirement analysis to identify problems related to the management of pavement data at airports, and also determines research objectives to address these problems with appropriate innovations in airport pavement information systems, based on theoretical analysis, which forms the basis for formulating the concept.

The next stage is the Design stage, where the initial design of the product or prototype is developed. This involves creating a flowchart or framework that serves as a guide for product development and product design. The design stage focuses on aligning the product with the identified research problems and objectives to ensure its relevance and feasibility for further development (Ramadhani et al., 2024).

This design stage is carried out according to the needs that have been analyzed, followed by the system design process. This process begins with the SIAP-YIA application design flowchart, which is then supplemented by a use case diagram that outlines how the application works. This stage also involves validation from media experts and material experts as part of the validation process.

Table 1. Validation Criteria

No	Score in Precent	Scale	Criteria
1	<21%	1	Very Not Feasible
2	21-40 %	2	Not Feasible
3	41-60 %	3	Feasible Enough
4	61-80 %	4	Feasible
5	81-100 %	5	Very Feasible

Results And Discussions

SIAP-YIA is a web-based application designed to be accessed using Android or a web browser via the internet network. This application design uses App Sheet which is a platform for developing mobile and web applications using coding skills. The application is dynamic and can be used across devices or browsers. The application interface design uses UX templates to create maps, calendars, dashboards, and more (Patresia, 2022). Automated workflows can also be integrated into the application to perform tasks such as sending notifications, generating emails, creating custom reports, and updating

data across connected sources (Sitio et al., 2023).

The design of SIAP-YIA begins with the creation of a flowchart that aims to describe the problem-solving sequence simply, neatly, and clearly. At this stage, it also explains to ensures that the program has its flow and has a reference in the preparation and development of the application (Maulani, 2020). Here is a description of the entire system.

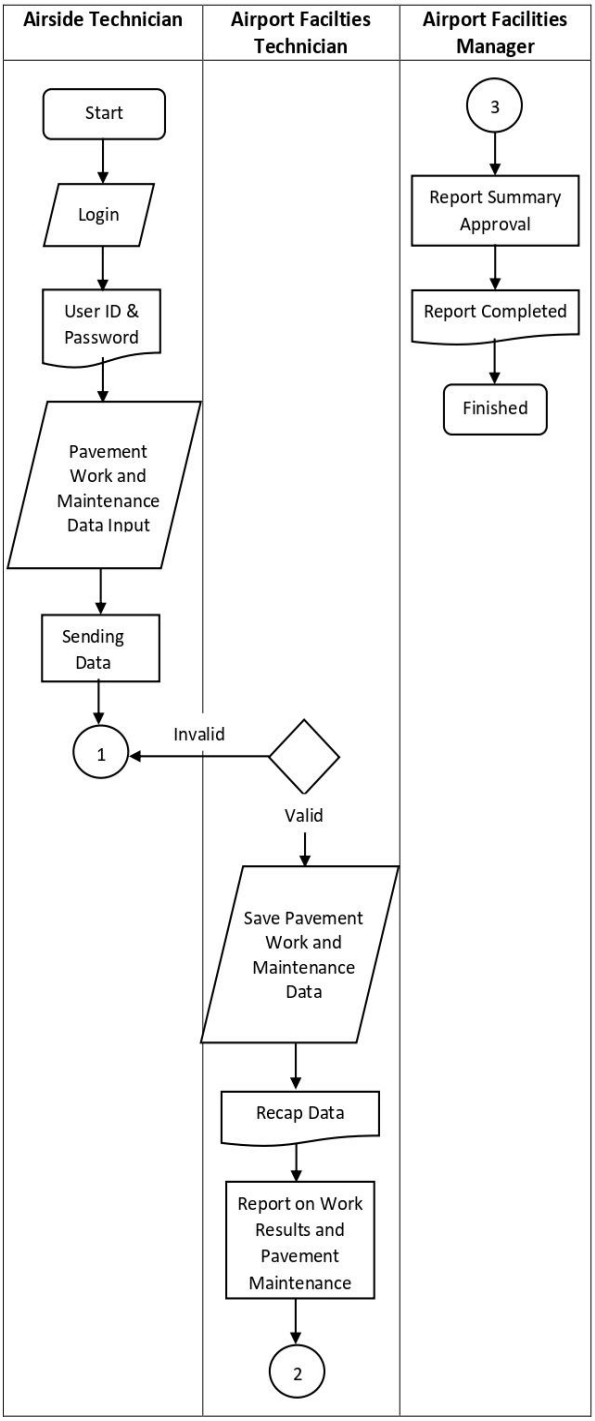

Figure 3. Flowchart Application

This application is an internal application that can only be accessed by airside technicians, airport facilities technicians, and airport facilities managers. External parties cannot access it unless they have permission from the unit manager.

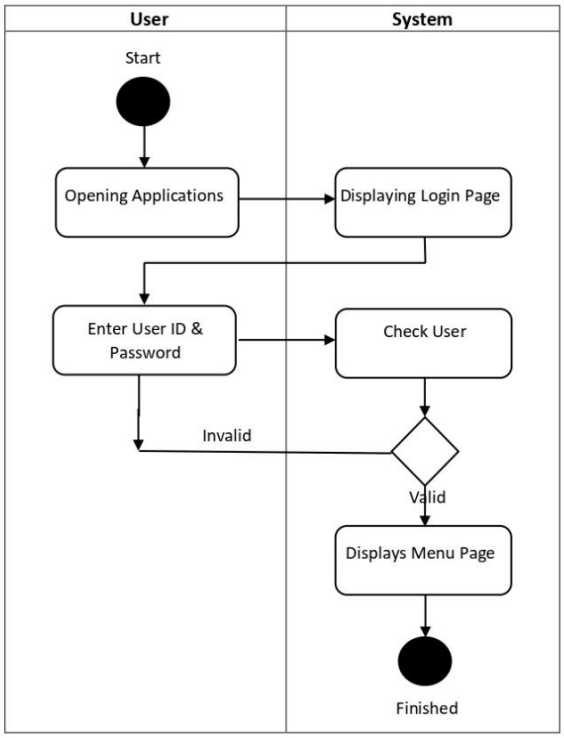

Figure 4. User Login Flowchart

Next, a use case diagram is designed to describe the relationship between the office and the system. Use case diagrams are used to find out what functions are in a system (Purnia et al., 2019).

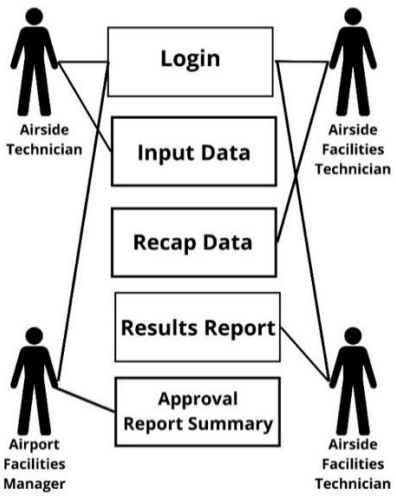

Figure 5. Use Case Diagram

After designing the flowchart and use case diagram, the next step is to create an

application using App Sheet software, which is software for applications or the web using simple coding (Fidharea & Utami, 2023). App sheets are created from data sources such as spreadsheets, Cloud SQL, Salesforce, and other similar connectors. The following is an admin view that can be used to manage this application.

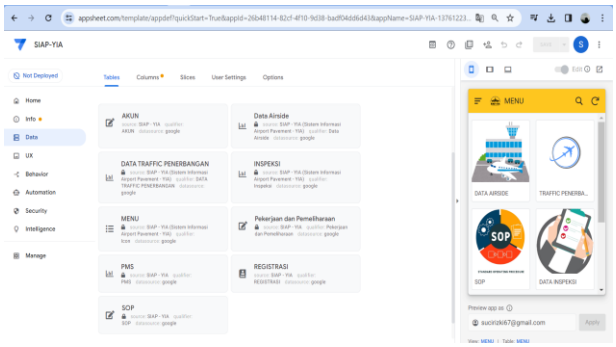

Figure 6. Application Admin Interface

The application interface includes the main display and menu display model on the mobile app system to be developed. The design selection is tailored to the needs of pavement data archivists in the current situation. Here is the design of this application (Saputra et al., 2023).

The following is the registration page on the application. This page is used if the user does not have an account on the application. The user can then register to continue logging in and access the main menu.

Figure 7. Registration Page

Furthermore, this login page can be accessed by admins and users by logging in using their user ID and password to enter the main menu of the application.

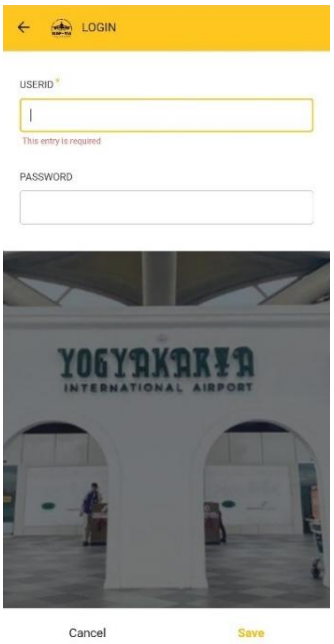

Figure 8. Login Page

The following menu page displays the menu options for Airside data, flight traffic, SOP, inspection data, work and maintenance, and PMS.

Figure 9. Menu Page

This airside data display contains Aeronautical Information Publication (AIP) data at the airport.

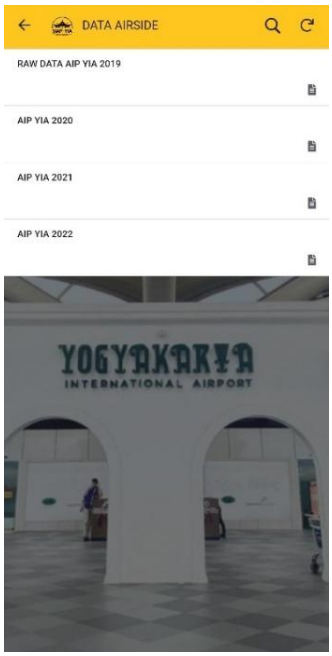

Figure 10. Airside Data Page

The Flight Traffic page contains a recapitulation of departure data, aircraft arrivals, passenger data, and cargo data.

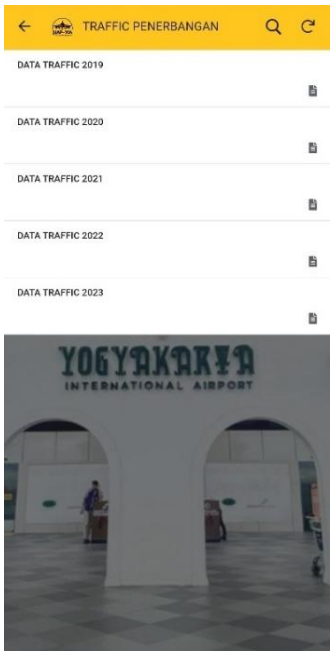

Figure 11. Traffic Aircraft Page

The following is a display of the SOP page, which contains various SOPs for paving work at the airport, including laws, Government Regulations, Ministerial Regulations, the Yogyakarta International Airport Aerodrome Manual, Work Instructions, Quality Procedures, and others.

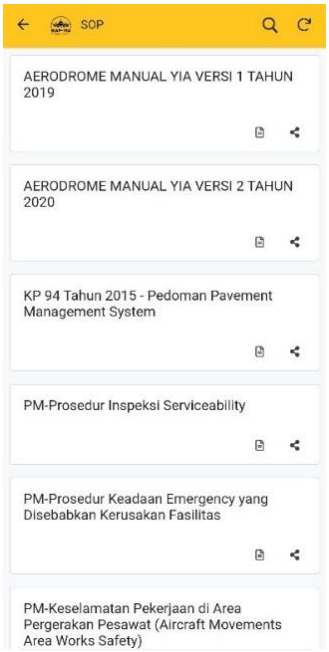

Figure 12. SOP Page

On the inspection page is a recapitulation of inspections for one year, which is divided into monthly and daily.

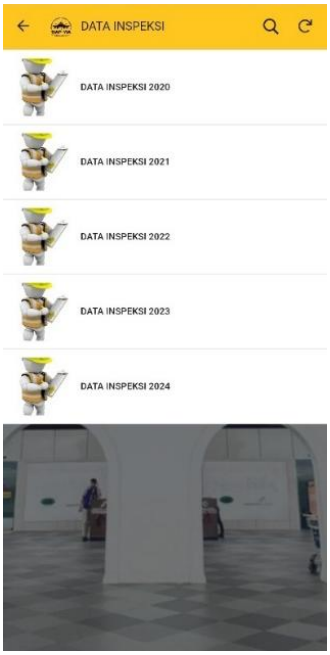

Figure 13. Inspection Data Page

The following is a page of work and maintenance that outlines various activities performed on airport pavements, including weak spot repairs, overlay work, runway surface roughness testing, rubber deposit cleaning, taxiway pavement surface monitoring, and roughness leveling.

Figure 14. Jobs and Maintenance Page

The last menu is the PMS (Pavement Management System) menu, which contains data on the airport's pavement construction and maintenance program for the past year.

Figure 15. PMS Page

At the validation stage of product design, researchers validate the appearance, coloring, letters, images, and menu display to see whether the features presented are sufficient to meet the needs (Septiani et al., 2024). The results obtained from the design expert's analysis of the SIAP-YIA application were 88% for each aspect according to the needs.

Table 2. Design Validation Results

No	Assessment Aspect	Scale	Percentage	Criteria
1	Display	4,5	90	Very Feasible
2	Color	4	80	Feasible
3	Letter	5	100	Very Feasible
4	Figure	4,5	90	Very Feasible
5	Menu	4	80	Feasible
	Average	4,4	88	Very Feasible

Next, to determine whether the application's features are suitable or not, the author employs the Forum Group Discussion (FGD) as a method to gather application results tailored to airport needs. The FGD method is one strategy for collecting data that involves social interaction between individuals in a

discussion (Afiyanti, 2008). The implementation of this FGD was carried out simultaneously with the implementation of the OJT report hearing at Yogyakarta International Airport in January 2024, where the members of the FGD were Mr. Viktor Suryan, a lecturer in Civil Engineering at Poltekbang Palembang, Mrs. Aldila Kurnia, an Airport Supervisor, and Mrs. Yulianti, an employee of BPSDMP. Mrs. Maya Nurmalia approved it as the Manager of Airport Facilities at Yogyakarta International Airport. The SIAP-YIA application has been developed to meet the needs of Yogyakarta International Airport, so it is hoped that this application can be implemented soon.

This application, in addition to being obtained from YIA, is also guided by Advisory Circular (AC No: 150/53807 B), which emphasizes the importance of an efficient database, a complete pavement inventory, information on the airport's pavement structure, and regular monitoring of pavement conditions. In addition to being an archivist, this application can also help leaders in making fast and accurate decisions because the data is integrated.

Conclusion

The Airport Pavement Information System (SIAP-YIA), an application-based innovation, enables facilities personnel and technicians to store and report pavement data at Yogyakarta International Airport. This application is located in the Airport Facilities unit, specifically for airside technicians. It features a registration and login page for security purposes, allowing us to identify who accesses this application. This application features six menus: Airside Data, Flight Traffic, SOP, Inspection Data, Work and Maintenance, and PMS. This application is also expected to facilitate and minimize errors in the location of data storage by Airside Facilities Technicians and Airside Technicians so that it is designed to be light, simple, and attractive to create a good and interesting experience when using it. Of course, with this application, pavement data storage can be computerized properly and has a database, allowing it to reduce the accumulation of documents and prevent the loss of documents in other files. The system design can still be further developed systematically to allow for additional improvements.

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