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Design of Kalamove (Kalimarau Apron Movement Report) to Optimize AMC Reporting at UPBU Airport Class 1 Kalimarau

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Abstract

Kalimarau Airport is a Class I UPBU airport that has a strategic role as the main gateway to air transportation in the Berau region, East Kalimantan. One of the important elements in supporting smooth operations at the airport is the Apron Movement Control (AMC) Unit which is in charge of recording and reporting aircraft movements. However, the current system for recording and reporting aircraft movements is still semi-digital, i.e. recording is done through Google Sheets and sent through WhatsApp groups, making it prone to data duplication, input errors, and being buried by other conversations. In response to these problems, the KALAMOVE (Kalimarau Apron Movement Report) system was developed as a web-based aircraft movement recording and reporting solution specifically designed to support the work efficiency of Apron Movement Control (AMC) personnel. KALAMOVE allows recording and reporting of aircraft movements to be done in real-time, accurately, and integrated in one system. This research uses the Research and Development (RnD) method with the ADDIE model approach which is limited to the development stage due to limited research time. The results of expert validation showed that the KALAMOVE system was declared very feasible to use, with a positive assessment of its appearance and function. And it is expected that in the future there will be further development to perfect this aircraft movement recording and reporting system.

1 INTRODUCTION

Airports are transportation infrastructure that play an important role in supporting the mobility of people and goods [1]. Kalimarau Airport, located in Berau, East Kalimantan, is a Class I airport managed by the Airport Management Unit and serves as a hub for commercial flights in the region. According to [2] Directorate General of Civil Aviation Regulation No. KP 38 of 2017 on Apron Management Services, the regulation of aircraft movements on the apron and its implementation are the responsibility of the airport operator. To ensure smooth apron operations, the Apron Movement Control Unit (AMC) is tasked with monitoring aircraft movements, recording arrival and departure times, and reporting flight, passenger, and cargo data to relevant parties [3]. However, the current reporting process still uses semi-digital tools such as Google Spreadsheets and WhatsApp, which are prone to data loss, duplication, and misunderstandings, potentially hindering operational performance. Therefore, an information system is needed to fill out daily reports digitally to improve effectiveness and efficiency, maintain the security of AMC officer reporting, and minimize errors by personnel [4] [5] [6] [7]. In response to this challenge, a system is needed that can provide a digital and real-time apron movement reporting solution. KALAMOVE (Kalimarau Apron

Movement Report) is a web-based platform designed to improve efficiency, accuracy, and transparency in recording aircraft, passenger, cargo, and freight movements at Kalimarau Airport. KALAMOVE will enable AMC staff to record, report, and monitor all apron movement activities in real-time using accessible technology and a robust data integration system. The platform facilitates faster report generation, prevents reporting errors, and enables real-time access to information for all relevant parties.

2 METHOD

This study uses a Research and Development (RnD) approach with the ADDIE (Analyze-Design-Development-Implement-Evaluate) model developed by Dick and Carry (1996) [8]. However,[9] the scope of this research is limited to the Development phase due to operational constraints and limited time at Kalimarau Airport. The development of this website is specifically intended for internal airport needs, so the most relevant initial stage is to produce a prototype that can be validated functionally and visually first. Therefore, this research focuses on the development of the structure, design, and initial system of the website.

Figure 1. Research Design

Analysis

At this stage, the probable causes for a performance GAP [10] were identified. To identify this, a needs analysis was conducted to analyze the reporting system sent through the WhatsApp group used at Kalimarau Airport, Berau. In this study, data collection techniques were carried out through observation, documentation, and the distribution of questionnaires. Observations were conducted through direct observation to document conditions related to the research objectives and to identify the current reporting system. According to [11], documentation is the collection of data from documents, archives, or written materials such as notes, reports, letters, books, or official documents related to the research. Furthermore, needs analysis was conducted using the PIECES (Performance, Information, Economy, Control, Efficiency, and Service) method approach as proposed by [12], which aims to identify various critical aspects that need to be improved in the designed system. The following are the six variables in this method:

a. Performance, focusing on assessing the extent to which the information system can be improved and how reliable the system is in achieving its objectives.
b. Information, assessing whether current procedures can still be improved to produce higher quality information.
c. Economy, assessing whether the methods currently used can be improved to be more efficient and optimize costs.
d. Control, assessing whether existing procedures can be improved to provide better control and more effective error detection.
e. Efficiency, assessing whether current procedures can be improved to increase operational efficiency and outperform manual systems.
f. Service, assessing whether current procedures can be improved to enhance service quality, with a focus on a more convenient and satisfying user experience.

The assessment in this study used a 1–5 Likert scale, ranging from strongly disagree to strongly agree, as an interval scale that allows quantitative analysis based on value differences.

Table 1. Likert Scale Score

No	Answer	Value
1.	Strongly agree	5
2.	Agree	4
3.	Neutral	3
4.	Disagree	2
5.	Strongly disagree	1

$$P_s = \frac{S}{N} \times 100\%$$

Explanation:
P_s = Percentage of Components
S = Total Research Component Score
N = Maximum Score
Interpretation of questionnaire assessment using a Likert scale:

Table 2. Interpretation of Questionnaire Instrument Assessment

Assessment	Scale
0% - 20%	Not necessary at all
21% - 40%	Not necessary
41% - 60%	Somewhat necessary
61% - 80%	Necessary
81% - 100%	Very necessary

The questionnaire in this needs analysis was distributed to 35 other relevant airport officials to gather user requirements.

Design
The results of the previous analysis stage are used as the basis for designing and compiling elements in an application, including the display, features, and system structure, so that it can function optimally according to user needs. With a Data Flow Diagram (DFD), you can illustrate the data flow in an information system to make it easier to understand the structure of this website [13].

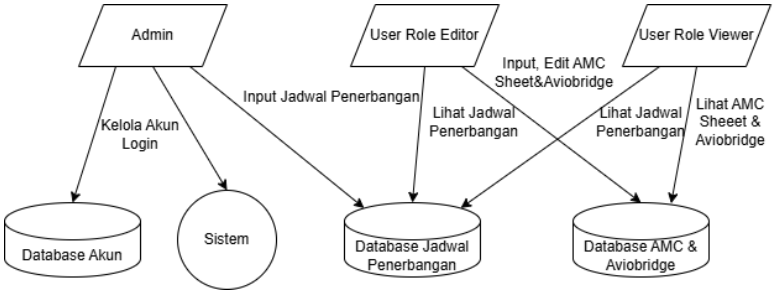


Figure 2. DFD Website KALAMOVE

Development
At this stage, the system is developed based on the design results that have been compiled previously. The main focus of this stage is to build a web-based application that can be used to digitally record and report aircraft movements through the KALAMOVE system. Development is carried out using several programming languages and tools such as HTML, CSS, JavaScript, PHP, and MySQL as the database. This system is also tested through a website validation process by experts to ensure its functional and visual feasibility.

3 RESULTS

Results of Analysis
Observations of the KALAMOVE (Kalimarau Apron Movement Report) system show that the current process is still manual and utilizes common applications such as WhatsApp and Google Spreadsheets. Although simple and easy to use, this system has several limitations. In terms of performance and efficiency, the reporting process requires additional time because data must be downloaded and is not fully automated, potentially hindering the speed of decision-making. In terms of information and control, access to data is still limited and searching for previous reports is quite time-consuming because there is no centralized search feature or audit trail. From an economic perspective, although it does not require large costs, the limitations of the system have the potential to cause indirect losses in terms of time and energy. Meanwhile, from a service perspective, this manual system is considered impractical because the validation and correction process requires quite a long series of steps. Through questionnaires administered to 35 airport personnel (AMC personnel, ground handling personnel, and commercial personnel) using the PIECES method yielded the following results:

Table 3. Questionnaire Results Needs Analysis

No	Respondents Questionnaire Score					Total Respondents	Total value	Total Questionaire Score	Index%	Assesment Interval
	SS (Strongly Agree)	S (Agree)	C (Neutral)	TS (Disagree)	STS (Strongly Disagree)					
	5	4	3	2	1					
Performance										
1	20	15	0	0	0	35	160	784	89,6%	Very Necessary
2	19	16	0	0	0	35	159			
3	17	18	0	0	0	35	157			
4	16	19	0	0	0	35	156			
5	13	21	0	0	0	35	152			
Information										
6	24	11	0	0	0	35	164	458	87,2%	Very Necessary
7	13	19	3	0	0	35	150			
8	10	19	6	0	0	35	144			
Economy										
9	10	13	12	0	0	35	138	138	78,9%	Necessary
Control										
10	22	13	0	0	0	35	162	482	91,8%	Very Necessary
11	20	15	0	0	0	35	160			
12	20	15	0	0	0	35	160			

Efficiency										
13	14	12	9	0	0	35	145	302	86,3%	Very Necessary
14	21	10	4	0	0	35	157			
Service										
15	21	14	0	0	0	35	161	161	92%	Very Necessary

The above results indicate that the need for a digital reporting system is very high, especially in terms of performance, control, and service, thus requiring an integrated system that supports real-time reporting, fast data retrieval, as well as security and ease of access.

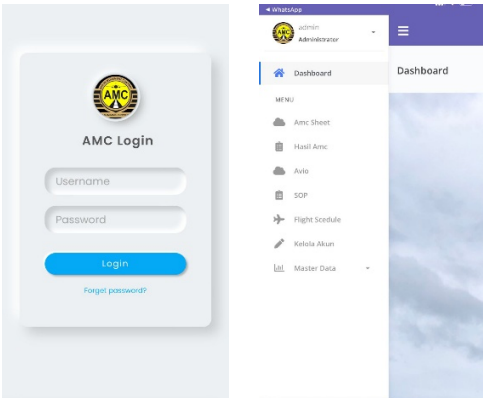
Result of Design

From the above analysis, we can conclude what kind of website AMC Kalimarau personnel need to support their work. Therefore, knowledge of several required features and their functions is necessary.

User Interface

The UI functions as a connector or translator of information between users and the information system so that the computer can be used [14]. In this study, the UI was designed using a web-based Graphical User Interface (GUI) to make it more interactive, responsive, and easier for users to understand [15], especially Apron Movement Control (AMC) officers. The UI display was designed to be accessible through various devices, both computers and smartphones, to support the mobility and work efficiency of AMC personnel in the field.

1. Login and Main Menu



(a) (b)

Figure 3. (a) Login Menu Display (b)Main Menu

Figure 3. above shows the login page for user authentication before accessing the system and the menu page on the website https://syntech.my.id/KALAMOVE/index.php.

2. AMC Sheet

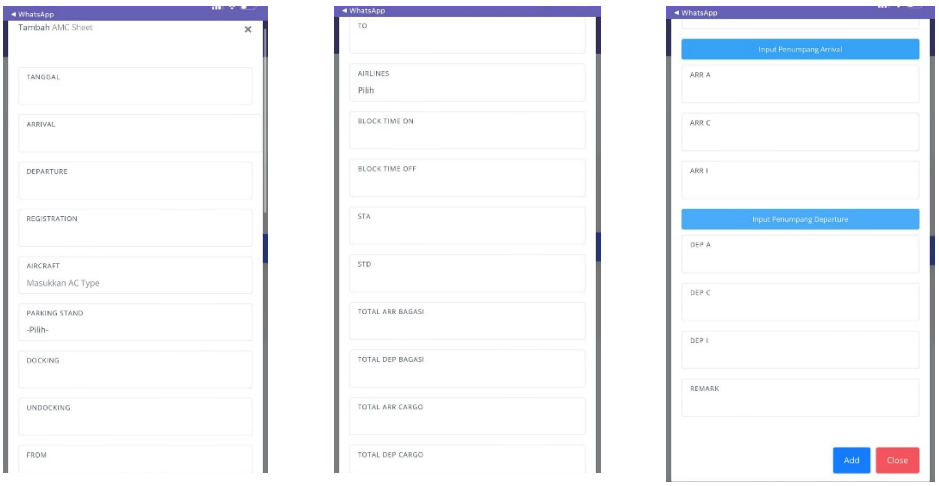


Figure 4. AMC Sheet Menu

Figure 4 above shows the AMC Sheet menu, which is used to enter and edit AMC (Airport Movement Control) data directly into the system. This menu can be used by administrators and users as editors. The following data must be entered into the AMC sheet:

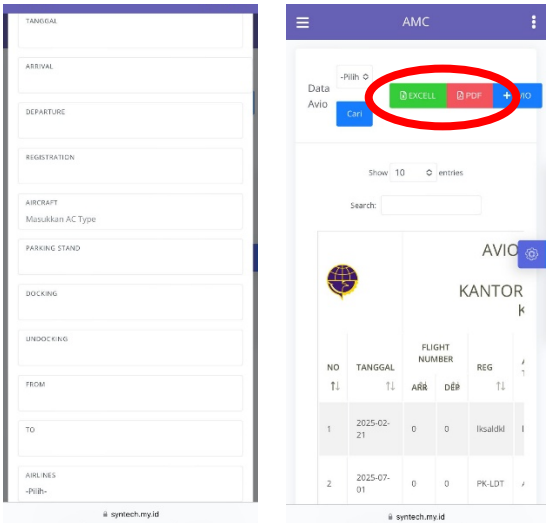
a) Date of AMC Sheet creation
b) Arrival and departure airports
c) Aircraft registration number
d) Aircraft type
e) Parking stand selection
f) Docking and undocking times
g) Airline name
h) Block on/off times
i) Schduled Time Arrival (STA)
j) Scheduled Time Departure (STD)
k) Total incoming/outgoing baggage
l) Total incoming/outgoing cargo
m) Number of incoming/outgoing passengers (adults/children/infants)

3. Result of AMC Sheet

Figure 5. AMC Sheet Results

Figure 5 shows a summary or recap of the AMC data that has been entered. This menu can be accessed by all users, including admins, users as editors, and users as viewers.

4. Aviobridge Menu



(a) (b)

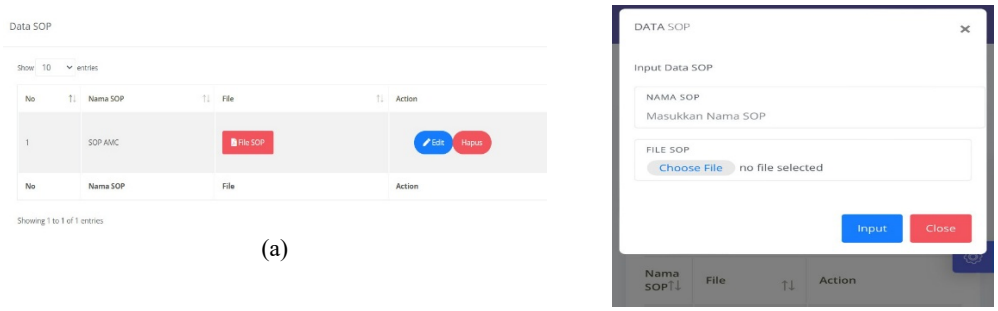
Figure 6. Figure 6. (a) Aviobridge Usage Data Input Display. (b) Button to Print Aviobridge Results

Figure 6 (a) shows the Aviobridge menu, which is used to fill in Aviobridge usage on the KALAMOVE website. This aviobridge usage recording feature can only be used by administrators and users as editors.

a) Date of aviobridge data entry
b) Arrival and departure airports
c) Aircraft registration number
d) Aircraft type
e) Parking stand
f) Docking and undocking times
g) Airline name

For image 6 (b), the green button prints the aviobridge results in Excel format and the red button prints the aviobridge results in PDF format. The feature to view and print results using Aviobridge can be accessed by all users, including admins, users as editors, and users as viewers.

5. SOP Menu



(a) (b)

Figure 7. (a) SOP Menu Display for Admin and Users as Editors (b) SOP File Input

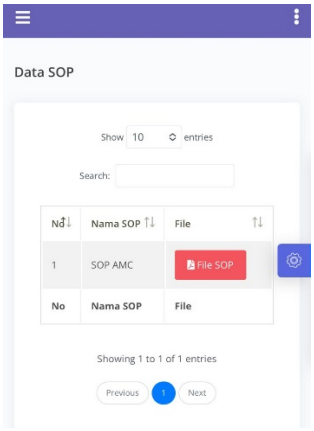
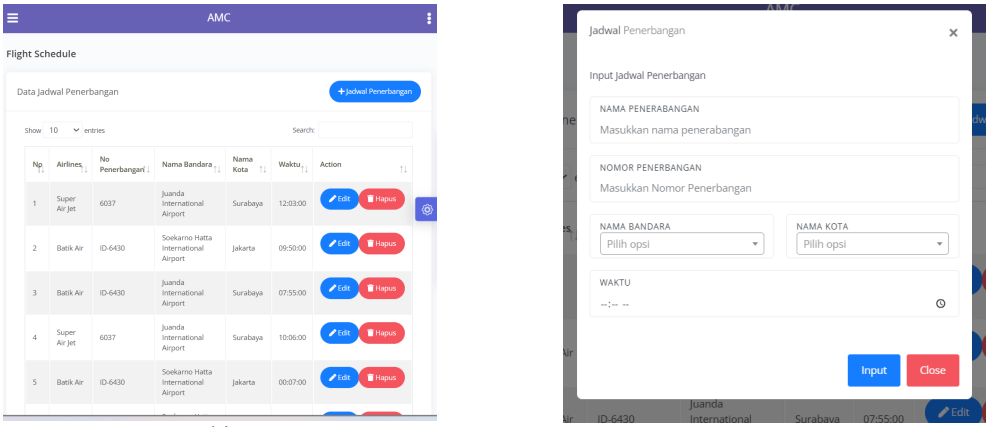


Figure 8. SOP Menu Display for Users as Viewers

Figure 7 shows the menu display for administrators and users as editors, where they can input/edit/delete existing standard operating procedure (SOP) files. Meanwhile, Figure 8 shows the display for users as viewers, who can only view and download SOP files.

6. Flight Scheule



(a) (b)

Figure 9. (a)Flight Schedule Menu Display for Admin and User as Editor (b)Flight Schedule Entry Display

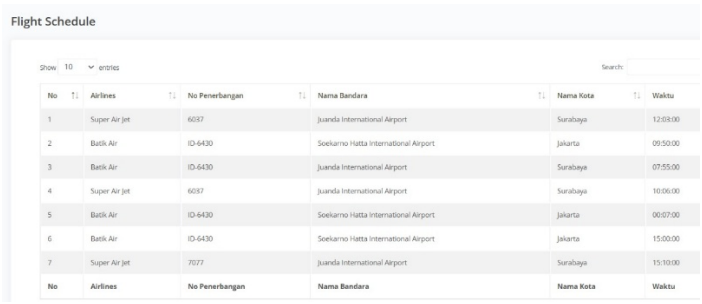
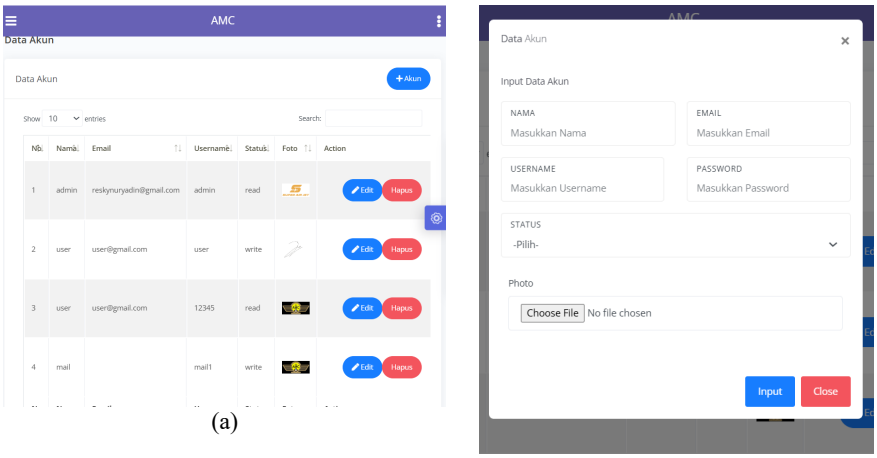


Figure 10. Flight Schedule Menu Display for User as Viewer

Figure 9 shows the menu display for administrators and users as editors, where they can input/edit/delete flight schedules. Meanwhile, Figure 10 shows the display for users as viewers, who can only view flight schedules.

7. Account Management

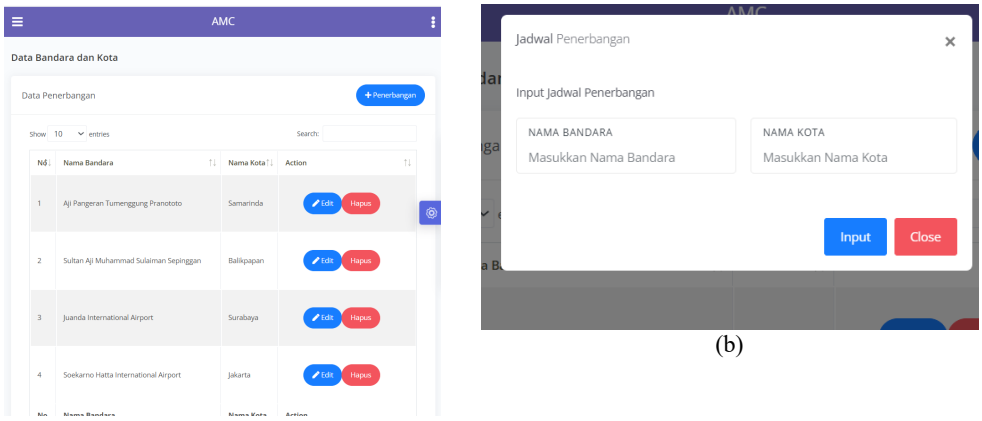


(a) (b)

Figure 11. (a) Account Management Menu Display on the admin (b) Account Creation

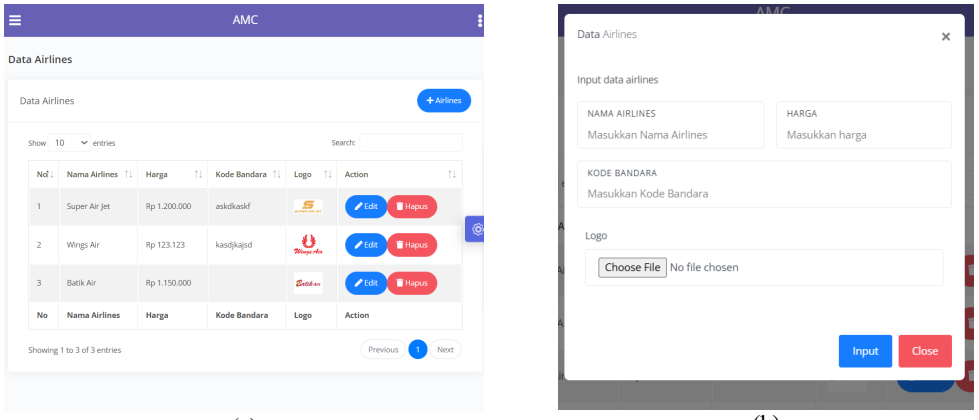
Figure 11 shows the user account management screen, where administrators can create accounts and select access rights appropriate for each user. This feature is only available to administrators. Administrators have the right to create, edit, and delete accounts.

8. Master Data



(a) (b)

Figure 12. (a) Airport Master Data Menu Display (b) Airport Master Data Entry



(a) (b)

Figure 13. (a) Airline Master Data Menu Display (b) Airline Master Data Entry

Figure 12 shows the airport master data feature, while Figure 13 shows the airline master data feature. This master data is created to manage key data in the system for easier use.

Development Result

After the design stage is complete, the KALAMOVE website will first be tested by experts before it is used by actual users. The feasibility test is conducted by four experts who assess the functionality, interface, and ease of use of the system using a Likert scale. The assessment results are shown in the following table.

Table 4. Expert Ralidation Results

No	Aspect	Result(%)	Description
1	Interface Display	93, 75%	Very Good
2	Appropriate Features	96,25%	Very Good
3	System Usability	98,43%	Very Good
4	Overall Functionality	100%	Very Good

In general, the validation results show that:

a. Functional aspects include interface display, login features, data input and output (AMC, Aviobridge, SOP, Flight Schedule), and account management, which obtained an index of between 87.50% and 100%, with an overall average of 96.25% (very feasible).
b. System Usability aspects, including data output and system management, obtained an average index of 98.43% (very feasible).
c. Interface aspects related to ease of use, ease of understanding features, and the feasibility of the system as a medium for recording aircraft movements obtained an average index of 96.87% (very feasible).
d. The overall System Functionality was rated 100% highly suitable.

Thus, the KALAMOVE system is declared highly suitable for use as a medium for recording and reporting aircraft movements in Apron Movement Control.

4 CONCLUSION

The results of the study show that the KALAMOVE (Kalimarau Apron Movement Report) system that was developed is capable of supporting the process of recording and reporting aircraft movements in a more structured, efficient, and integrated manner. This system was designed using the ADDIE development model up to the development stage, so that it no longer relies on manual methods and messaging applications. The implementation of KALAMOVE has made a positive contribution to optimizing reporting in the apron area and supports the smooth operation and improved performance of the Apron Movement Control unit at Kalimarau Airport. In addition, validation results by experts show that this system is highly suitable for use, both in terms of functionality and interface appearance, with a rating in the "highly suitable" category.

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