



Design of Padang Online Parking Stand Information System to Support Air Traffic Service

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ABSTRACT

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Inefficient management of the parking stand information system has an impact on the smoothness of air traffic services at an airport. This research aims to develop a design of a parking stand information system at Minangkabau International Airport (POSTAND). The information system is designed by the Rapid Application Development (RAD) methodology and the UX design implemented by Figma. The data collection technique used in this study is a sample questionnaire with usability assessment criteria involving 14 Air Traffic Controllers (ATCs) as respondents. The data processing results indicate a "agree" category when the POSTAND system implemented at Airnav's Padang branch. From these findings, it can be concluded that this design has successfully created a system that is considered effective and better in supporting coordination and operational activities at Minangkabau International Airport, particularly between Air Traffic Controllers (ATCs) and Apron Movement Control (AMC) officers. This design is expected to facilitate the tasks of Apron Movement Control (AMC) and Air Traffic Controllers (ATCs), especially in terms of determining and providing parking stand information.

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INTRODUCTION

The rapid development of information technology in the present era aims to address various issues in various fields by creating information systems that are fast, accurate, and efficient so that the needed information can be generated and delivered as desired (Angkasa et al., 2015). Minangkabau International Airport is one of the airports in Indonesia that already employs several information systems to support its daily operations. This airport experiences heavy aircraft traffic, both in the maneuvering area and the movement area, necessitating information to facilitate smooth traffic flow to achieve the primary objectives of the "Five Objectives of Air Traffic Service." One of these objectives is to "Provide advice and information useful for the safe and efficient conduct of flights" (International Civil Aviation, 2016), emphasizing the importance of safety and efficiency, which requires the responsibility of air traffic controllers both in the air and on the ground. According to Kamus Besar Bahasa Indonesia (KBBI), efficiency means the precision of the method (work effort) in carrying out something without wasting time, energy, effort, and cost.

During observations at Minangkabau International Airport for approximately five months from November to February 2022, issues related to the provision of parking stand information by Apron Movement Control (AMC) personnel needed by controllers in guiding aircraft traffic on the ground were identified. Based on the Letter of Coordination Agreement (LOCA) between Minangkabau Tower and the Airside Operation Unit, it outlines how to coordinate for arriving aircraft (arrival). For arrival scheduled flights, the Airside Operation Unit provides parking management/plotting to Minangkabau Tower before 00:00 UTC on the following day. If parking management/plotting cannot be carried out, Minangkabau Tower must convey the Estimated Time of Arrival (ETA) for aircraft landing at Minangkabau International Airport (BIM) to the Airside Operation Unit. Minangkabau Tower will receive a "parking stand" number from the Airside Operation Unit as soon as the Airside Operation Unit receives the ETA of the aircraft. The Airside Operation Unit informs Minangkabau Tower of the parking stand allocation for each arriving aircraft at least 10 minutes before ETA. The Airside Operation Unit must immediately inform Minangkabau Tower of any "parking stand" changes at least 5 minutes before ETA. If there is a request for a parking stand from the pilot, Minangkabau Tower immediately coordinates with the Airside Operation Unit (Lampiran 8 LOCA BIM - AIRNAV 2021, 2021) which is the AMC personnel.

Based on the LOCA, AMC personnel provide parking stand information for arriving aircraft through HT, and when the traffic volume starts to increase, AMC personnel aim to provide better service to facilitate air traffic control. As a result, AMC personnel send a file containing parking stand information for the daily arrivals to Minangkabau Tower via email. This file serves as a reference for determining parking stands. However, the file is inefficient and less accurate due to numerous information errors, such as mismatched arrival and departure information with the slots in CHRONOS. This can lead to aircraft not being correctly recorded in the file. Furthermore, the file sent by AMC is not user-friendly and appears too small, requiring controllers to zoom in.

If there are changes in parking stand slot information due to specific reasons, AMC personnel typically reschedule this information using Handy Talky (HT). Using HT during heavy traffic is inefficient and contributes to the load of communication, which can affect the initial objectives of air traffic control: ensuring safety, regularity, and efficiency in air traffic service. In this study, the primary focus is on how AMC personnel provide information regarding parking stands to controllers, as this information is crucial for ensuring the smooth and safe operation of flights at the airport.

Literature Review

The provision of parking stand information from Apron Movement Control (AMC) personnel to controllers is at the core of the issue in this study. A parking stand refers to a specific area at the airport used for parking aircraft. This area is marked with yellow letters and numbers on a black background, indicating the aircraft parking space number (Astrio adi nugraha, 2016). These parking stands are located on the apron, which is an airside facility at the airport used for various activities such as passenger disembarkation and embarkation, mail and cargo handling, refueling, parking, and aircraft maintenance (Astrio adi nugraha, 2016). Personnel working in the apron area are referred to as Apron Movement Control (AMC). They are airport personnel with licenses and ratings responsible for flight operations, aircraft movement supervision, vehicle movement, maintaining airside cleanliness, and recording flight data on the apron (Arif et al., 2016).

The development of information technology in the aviation industry is progressing rapidly, especially in the field of information systems. Information systems follow the concept that within a system, the output of the entire organization is expected to be greater than the output of each unit (Tatan Sutabri, 2012). Information system can be defined as a system created by humans that encompasses various components within an organization to achieve a goal, which is to produce information (Arifin, 2021). Information systems aim to collect, process, store, analyze, and disseminate information according to specific objectives (Abdul Kadir, 2014). The design of an information system involves developing a new system based on the existing system, with the hope that problems that may have arisen in the old system can be addressed in the new system (*Perancangan Sistem Informasi*, n.d.)

Law No. 1 of 2009 Article 1 explains that aviation is a unified system that involves airspace, aircraft, airports, air transport, flight navigation, safety and security, environmental concerns, as well as supporting

facilities and other public facilities (Undang-Undang Republik Indonesia Nomor 1 Tahun 2009 tentang Penerbangan, 2009). In conducting aviation activities at airports, specific objectives must be met to achieve efficiency, comfort, safety, and smooth operations. Therefore, Law No. 1 of 2009 Article 3 also outlines the objectives of aviation, which are to achieve the orderly, safe, secure, comfortable, reasonably priced, and to avoid unfair competition (President of the Republic of Indonesia, 2009). In other words, the development of information systems in aviation plays a crucial role in achieving these goals and provides benefits for efficiency and safety in airport flight operations.

To achieve efficiency in managing air traffic, technology development such as information systems can be utilized. These systems are widely used in the aviation industry in the form of applications that store various flight-related information, whether web-based, desktop, android, or others. The Republic of Indonesia Law No. 1 of 2009, Chapter XVIII on Flight Information Systems also regulate the utilization of information systems in aviation. Article 375 states that the flight information system includes the collection, processing, analysis, storage, presentation, and dissemination of flight data and information to (Presiden Republik Indonesia, 2009): a) improve services to the public; b) support policy formulation in aviation.

Article 377 explains that the implementation of the flight information system is carried out by building and developing an integrated, effective, and efficient information network involving relevant parties by utilizing information and communication technology developments (Undang-Undang Republik Indonesia Nomor 1 Tahun 2009 tentang Penerbangan, 2009). Meanwhile, Article 281 states that aviation telecommunications services, as referred to in Article 270 letter b, aim to provide information to create accuracy, regularity, and efficiency in flight (Pemerintah Indonesia, 2009). In the Republic of Indonesia Law No. 11 of 2008 on Electronic Information and Transactions, Article 17, paragraph (1) states, "This Law provides an opportunity for the use of Information Technology by state organizers, individuals, business entities, and/or the community. The utilization of Information Technology must be done in a good, wise, responsible, effective, and efficient manner to obtain the maximum benefit for the public" (Presiden Republik Indonesia, 2008).

In designing of information systems, one of the design tools that can be used is Figma. This application has gained high popularity among User Interface (UI) and User Experience (UX) designers due to its ability to facilitate real-time team collaboration and offer features that simplify the design process. Additionally, Figma has an advantage in terms of user-friendliness and accessibility because it can be accessed through a web browser without the need for downloading an application first (Fatmarani Surianto et al., 2023). Figma is a cloud-based and free design tool that can be accessed through a web browser or desktop application on both Windows and MAC OS operating systems. Figma's functionality and features are similar to Sketch or Adobe XD, but Figma has an advantage that sets it apart, which is its team collaboration feature. With Figma, users can access all the necessary tools for web project design, including vector tools that allow for comprehensive illustration creation, as well as the ability to create prototypes and generate code for handoff. In short, Figma is a browser-based UI and UX design application with excellent design, prototyping features, and tools for code production. Currently, Figma is one of the leading interface design tools in the industry, with advanced features that support teams in every phase of the design process (Ridho Nastainullah, 2022).

User Interface (UI) and User Experience (UX) are essential components of an application, website, or online platform. They can be determining factors in whether visitors are interested in exploring a particular platform. UI and UX are abbreviations for User Interface and User Experience, which refer to the visual aspects of digital marketing tools in the form of websites or applications, with the aim of enhancing an overall brand image. UI is a part of computers and software that can be seen, touched, heard, spoken to, and directly understood by users. UI includes techniques and mechanisms for interface display to facilitate pleasant interactions between users and the system. Thus, UI is responsible for arranging the interface display on computers or software to facilitate enjoyable user-system interactions. UI can also be seen as the result of the user experience (UX), which is visible. The UI/UX design of an application, website, or system should make it easy for users to operate because good UI/UX design makes users feel comfortable using the application(Wilbert O. Galitz., 2007). User Experience (UX) Design is the process of designing a product that is useful, easy to use, and enjoyable for users. The aim of this process is to enhance the overall experience individuals have when interacting with a product, ensuring that they find value, satisfaction, and pleasure (Miklos Philips, 2019).

One of the advantages of Figma is its ability to enable real-time team collaboration. This makes it easy for design teams to work together on a single project and speeds up the design process. Additionally, Figma provides features that facilitate the design process, such as prototyping and component features that allow users to create consistent and efficient designs (Bagus Bambang Sumantri et al., 2023). To measure the effectiveness and efficiency of a system, many companies worldwide have successfully used the USE questionnaire. USE is one of the non-commercial questionnaire packages that can be used to measure the usability of a system with the most comprehensive set of instruments compared to other methods (Maulida et al., 2023). Users are asked to assess their level of agreement with statements, ranging from strongly disagree to strongly agree. Various forms of questionnaires are employed to evaluate user attitudes toward various consumer products. Factor analysis in each study reveals that users primarily evaluate products based on three criteria: usefulness, ease, and user satisfaction. Although other criteria have been identified, these three criteria are the most effective in distinguishing interfaces.

Previous research, such as partial correlation analysis using a derived scale for these three criteria, shows that usability and ease of use mutually influence each other. Therefore, improving ease of use also enhances the usability rating, and vice versa. While both contribute to user satisfaction, usability plays a relatively less crucial role when the system is an internal system used by users. Users exhibited more varied differences in assessing usability when they have limited exposure to a product. As explained in the literature, user satisfaction is closely related to actual or predicted usage. For internal systems, the items contributing to ease of use for other products can be divided into two factors: ease of learning and ease of use (which are strongly correlated)(Lund, 2001).

METHOD

The methodology used in the design of the POSTAND system is based on the RAD (Rapid Application Development) methodology. The UI/UX design is carried out using the Figma application. This methodology is an approach in software development that focuses on progressive steps in the system development process. (Murdiani & Hermawan, n.d.v). Rapid Application Development (RAD) is a development cycle designed to deliver much faster development and higher-quality results (Ali Syahron, 2023). RAD aims to shorten the time typically required in the traditional system development life cycle between system design and implementation (Titania Pricillia, 2021)

Population and Sample

The population for this study includes Air Traffic Controllers (ATC) personnel and Apron Movement Control (AMC) staff at Minangkabau International Airport. The sample for this study was selected using cluster random sampling, which includes all ATC personnel at Minangkabau International Airport.

Research Phases

Research is one approach for scientifically solving problems or seeking answers to questions (Rahmani, Farkhatin, & Ningsih, 2022). The research phase applied in this study is Research & Development (R&D). Research and Development (R&D) is a research method that aims to produce products or innovations in a specific field, followed by secondary products to test the effectiveness of the main product. The products developed can be either hardware or software (Budiyono Saputro, 2017).

Data Collection Techniques

Data collection techniques in this study include observation, interviews, and sample questionnaires. Sample questionnaires were provided to all ATC personnel at Airnav's Padang branch, containing 15 statements. In this research, to ensure that the software created meets quality standards and user requirements, one of the methods used for quantitatively measuring usability, satisfaction, and ease of use of the software is the USE Questionnaire method (Rikardo Nainggolan, 2018).

RESULT AND DISCUSSION

The design of the POSTAND information system can be explained in the following display. The login menu is used for user validation who will use the system. This determines the access based on the user's role or position.

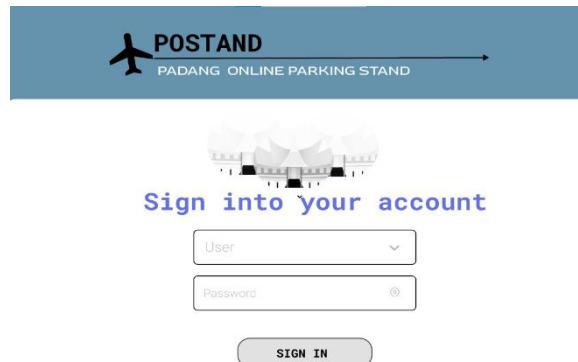


Figure 1. Display of Login AMC and TWR

Figure 1 represents the login menu of the POSTAND system. There are two types of users who can use this system, namely AMC and TWR. Each user has their own authority to access the menus in the POSTAND information system. The AMC section can access all the menus in this system, including adding, editing, and deleting parking stand slot data. The TWR section can only view and print parking stand slot data, view notifications, and contacts.

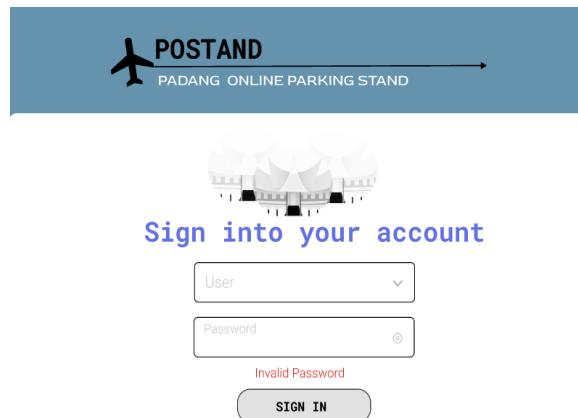


Figure 2. Notification of Invalid Password AMC and TWR

In Figure 2, the login menu of the POSTAND information system requires the users to enter their username and password for logging into the system. If the user makes an input error for the username and password, the main menu will not be displayed, and an "invalid password" warning will appear.

Display of TWR User



Figure 3. Main Display of TWR

Figure 3 shows the main menu display of the POSTAND system with the TWR user. The TWR user can access the menus within the system by clicking the menu bar located in the upper left corner. On the main menu page, there are three main options: the parking stand slot, notifications, and contacts.

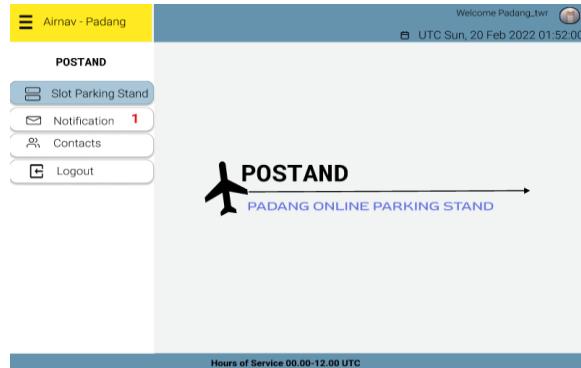


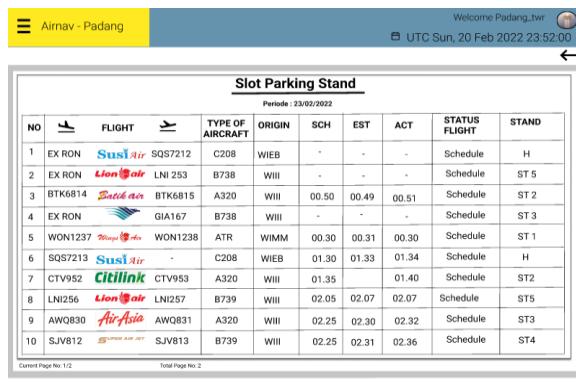
Figure 4. Display of TWR bar

Figure 4 represents the TWR user's menu bar in the POSTAND system. The TWR user can only view the parking stand slot, notifications, and contacts. If the TWR user clicks on the parking stand slot menu, a display like the one below will appear.

NO	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	SCH	EST	ACT	STATUS FLIGHT		STAND
							Schedule	Held	
1	EX RON	SQ57212	C208	WIEB	-	-	Schedule	H	
2	EX RON	LNI 253	B738	WIII	-	-	Schedule	ST 5	
3	BTK6814	BTK6815	A320	WIII	00.50	00.49	00.51	Schedule	ST 2
4	EX RON	GIA167	B738	WIII	-	-	Schedule	ST 3	
5	WON1237	WON1238	ATR	WIMM	00.30	00.31	00.30	Schedule	ST 1
6	SQS7213	*	C208	WIEB	01.30	01.33	01.34	Schedule	H
7	CTV952	CTV953	A320	WIII	01.35	01.35	01.40	Schedule	ST2
8	LNI256	LNI257	B739	WIII	02.05	02.07	02.07	Schedule	ST5
9	AWQ830	AWQ831	A320	WIII	02.25	02.30	02.32	Schedule	ST3
10	SJV812	SJV813	B739	WIII	02.25	02.31	02.36	Schedule	ST4

Figure 5. Display of Parking Stand TWR Slot

Figure 5 shows the parking stand slot for the TWR user. The TWR user can only view and print parking stand slot data. If the TWR user clicks the "Print" button, an information view of the parking stand slots ready to be printed will appear as shown below.

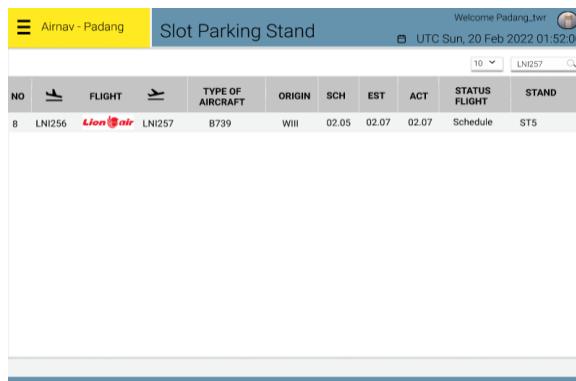


The screenshot shows a table titled "Slot Parking Stand" with the period set to 23/02/2022. The table includes columns for NO, FLIGHT, TYPE OF AIRCRAFT, ORIGIN, SCH, EST, ACT, STATUS FLIGHT, and STAND. The data rows show various flights from different airlines like Susi Air, Lion Air, Batik Air, Garuda Indonesia, and Citilink, along with their respective flight numbers, aircraft types (e.g., C208, B738), origin points (WIEB, WIIL, GIA167, WIMM), and current status (Schedule or ST 1-5).

NO	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	SCH	EST	ACT	STATUS FLIGHT		STAND
							SCHEDULE	ACTUAL	
1	EX RON	Susi Air SQS7212	C208	WIEB	-	-	-	-	Schedule H
2	EX RON	Lion Air LNI 253	B738	WIIL	-	-	-	-	Schedule ST 5
3	BTK6814	Batik Air BTK6815	A320	WIIL	00.50	00.49	00.51	-	Schedule ST 2
4	EX RON	Garuda GIA167	B738	WIIL	-	-	-	-	Schedule ST 3
5	WON1237	Mas Ai WON1238	ATR	WIMM	00.30	00.31	00.30	-	Schedule ST 1
6	SQS7213	Susi Air -	C208	WIEB	01.30	01.33	01.34	-	Schedule H
7	CTV952	Citilink CTV953	A320	WIIL	01.35	-	01.40	-	Schedule ST2
8	LN1256	Lion Air LN1257	B739	WIIL	02.05	02.07	02.07	-	Schedule ST5
9	AWQ830	Air Asia AWQ831	A320	WIIL	02.25	02.30	02.32	-	Schedule ST3
10	SJV812	Super Air Jet SJV813	B739	WIIL	02.25	02.31	02.36	-	Schedule ST4

Figure 6. Display of Printed Parking Stand TWR Slot

Figure 6 shows *parking stand slot when printed*. In the printed parking stand slot display, the user can return to the parking stand slot menu by clicking the "Back" button or by clicking the "Back" button on the menu bar located in the upper left corner of the display.

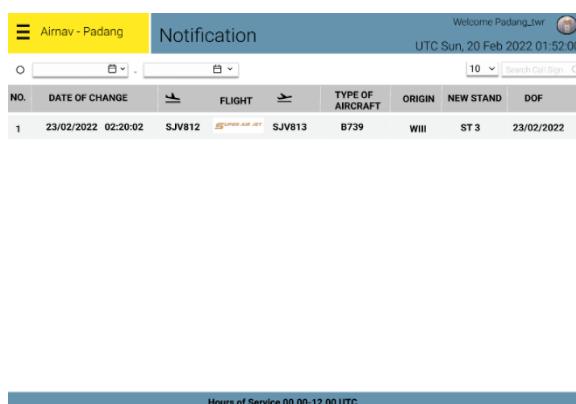


The screenshot shows a table titled "Slot Parking Stand" with the period set to 20 Feb 2022 01:52:00. The table includes columns for NO, FLIGHT, TYPE OF AIRCRAFT, ORIGIN, SCH, EST, ACT, STATUS FLIGHT, and STAND. A single row is displayed for flight LN1256, which is currently scheduled for ST 5.

NO	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	SCH	EST	ACT	STATUS FLIGHT		STAND
							SCHEDULE	ACTUAL	
8	LN1256	Lion Air LN1257	B739	WIIL	02.05	02.07	02.07	-	Schedule ST5

Figure 7. Display Menu Search Parking Stand Slot TWR

Figure 7 is a display of the search menu parking stand slot for TWR users. To find the parking stand slot data you want to search for, use TWR You can type the call sign you want to search for in the text box and click the search button. Then the information you are looking for will appear as shown above.



The screenshot shows a table titled "Notification" with the date of change set to 23/02/2022 02:20:02. The table includes columns for NO, DATE OF CHANGE, FLIGHT, TYPE OF AIRCRAFT, ORIGIN, NEW STAND, and DOF. A single notification is listed for flight SJV812, which has moved from ST 3 to ST 23/02/2022.

NO.	DATE OF CHANGE	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	NEW STAND		DOF
					SCH	ACT	
1	23/02/2022 02:20:02	SJV812 SJV812	Super Air Jet SJV813	B739	WIIL	ST 3	23/02/2022

Figure 8. Parking Stand Slot Notification Menu Display TWR

Figure 8 shows the notification menu display for TWR users. Users can search notifications based on the date of change and based on the call sign. If there is a notification of a new parking stand change and the user has not opened the information, then the notification menu bar will appear you will see a large number of notifications that have not been viewed. In the display above, you can see that the display is still in bold. If the user clicks on the notification, it will appear as follows.

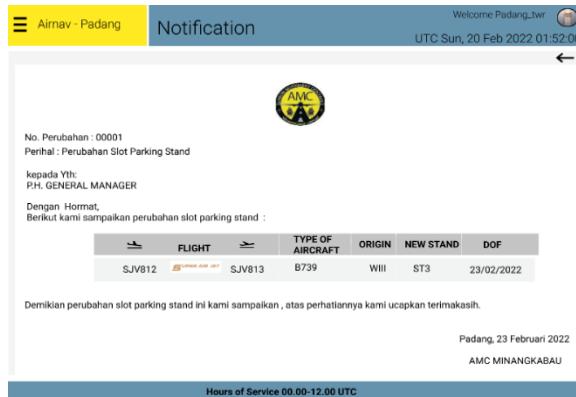


Figure 9. TWR Parking Stand Slot Change Notification Display

Figure 9 is the notification display for changes to parking stand slots for TWR users. Users can see detailed change information through this change notification display.

NO.	STAKEHOLDER	PIC Name	TELEPHONE	EMAIL	ALAMAT
1	AIRPORT ANGKASA PURA	AMC BIM PADANG	075181919123.2118	amcbimpadang@gmail.com	amcbimpadang@gmail.com
2	AIRNAV INDONESIA	ATFM PADANG	082286503400	amcbimpadang@gmail.com	Kantor Cabang Padang
3	AIRNAV INDONESIA	ATFM PADANG	082286503400	amcbimpadang@gmail.com	Kantor Cabang Padang

Figure 10. TWR Contacts Menu Display

Figure 10 shows the contacts menu display for TWR users. TWR users can only see the contacts menu display. The contacts menu contains information about parties related to the airport. TWR users can use this contact information.

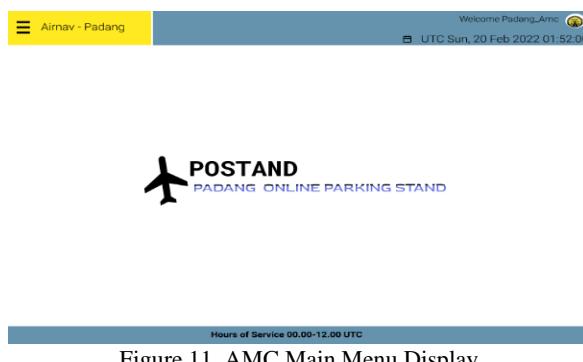
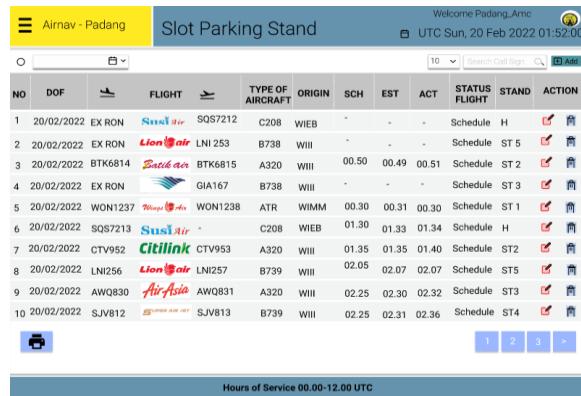


Figure 11. AMC Main Menu Display

Figure 11 shows the main menu display of the POSTAND system with the AMC user. AMC users can access the menus contained in this system by clicking on the menu bar located at the top left.

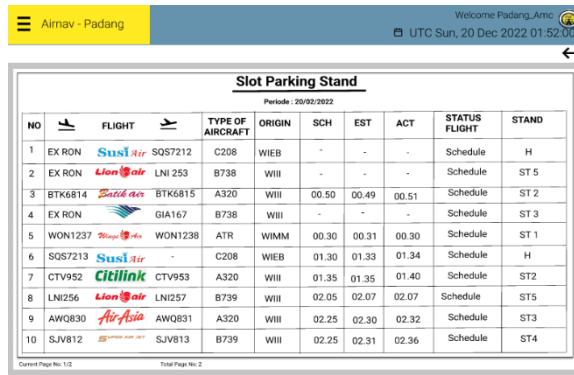


The screenshot shows a table titled "Slot Parking Stand" with the following columns: NO, DOF, FLIGHT, TYPE OF AIRCRAFT, ORIGIN, SCH, EST, ACT, STATUS, FLIGHT, STAND, and ACTION. The data is as follows:

NO	DOF	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	SCH	EST	ACT	STATUS	FLIGHT	STAND	ACTION	
1	20/02/2022	EX RON	SusAir SQS7212	C208	WIEB	-	-	-	Schedule	H		
2	20/02/2022	EX RON	LionAir LNI 253	B738	WIII	-	-	-	Schedule	ST 5		
3	20/02/2022	BTK6814	Batik Air BTK6815	A320	WIII	00.50	00.49	00.51	Schedule	ST 2		
4	20/02/2022	EX RON	GIA167	B738	WIII	-	-	-	Schedule	ST 3		
5	20/02/2022	WON1237	WON1238	ATR	WIMM	00.30	00.31	00.30	Schedule	ST 1		
6	20/02/2022	SQS7213	SusAir	C208	WIEB	01.30	01.33	01.34	Schedule	H		
7	20/02/2022	CTV952	Citilink	CTV953	A320	WIII	01.35	01.35	01.40	Schedule	ST 2	
8	20/02/2022	LN1256	LionAir LN1257	B739	WIII	02.05	02.07	02.07	Schedule	ST 5		
9	20/02/2022	AWQ830	AirAsia AWQ831	A320	WIII	02.25	02.30	02.32	Schedule	ST 3		
10	20/02/2022	SJV812	SJL813	B739	WIII	02.25	02.31	02.36	Schedule	ST 4		

Figure 12. AMC Parking Stand Slot Menu Display

Figure 12 is a display of the form parking stand slot for AMC users. AMC users can add, edit and delete parking stand slot data. To add new parking stand slot data, the user can click the add button. If the AMC user wants to print the parking stand slot data, the user can click the print button and the parking stand slot information display will appear ready to be printed.



The screenshot shows the same table as Figure 12, but it includes a "Print" button at the bottom left and a back arrow at the top right.

NO	DOF	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	SCH	EST	ACT	STATUS	FLIGHT	STAND	
1	EX RON	SusAir SQS7212	C208	WIEB	-	-	-	Schedule	H		
2	EX RON	LionAir LNI 253	B738	WIII	-	-	-	Schedule	ST 5		
3	BTK6814	Batik Air BTK6815	A320	WIII	00.50	00.49	00.51	Schedule	ST 2		
4	EX RON	GIA167	B738	WIII	-	-	-	Schedule	ST 3		
5	WON1237	WON1238	ATR	WIMM	00.30	00.31	00.30	Schedule	ST 1		
6	SQS7213	SusAir	C208	WIEB	01.30	01.33	01.34	Schedule	H		
7	CTV952	Citilink	CTV953	A320	WIII	01.35	01.35	01.40	Schedule	ST 2	
8	LN1256	LionAir LN1257	B739	WIII	02.05	02.07	02.07	Schedule	ST 5		
9	AWQ830	AirAsia AWQ831	A320	WIII	02.25	02.30	02.32	Schedule	ST 3		
10	SJV812	SJL813	B739	WIII	02.25	02.31	02.36	Schedule	ST 4		

Figure 13. AMC Parking Stand Slot Print Menu Display

Figure 13 shows the parking stand slot information display when printed. In the image of the print slot parking stand menu display, the user can return to the slot parking stand menu by clicking the back button or clicking the menu bar button again at the left top of the display.



The screenshot shows the same table as Figure 12, but it includes a search bar at the top and a date selection button.

NO	DOF	FLIGHT	TYPE OF AIRCRAFT	ORIGIN	SCH	EST	ACT	STATUS	FLIGHT	STAND		
1	11/02/2022	EX RON	SusAir SQS7212	C208	WIGM	-	-	-	Schedule	H		
2	11/02/2022	EX RON	LionAir LNI 253	B738	WIII	-	-	-	Schedule	ST 5		
3	11/02/2022	BTK6814	Batik Air BTK6815	A320	WIII	00.40	00.30	00.35	Schedule	ST 3		
4	11/02/2022	CTV952	Citilink CTV957	B738	WIII	00.45	00.31	00.37	Schedule	ST 2		
5	11/02/2022	EX RON	WON1238	ATR	WIMM	-	-	-	Schedule	ST 1		
6	11/02/2022	SQS7213	SusAir	C208	WIGM	01.30	01.33	01.34	Schedule	H		
7	11/02/2022	CTV952	Citilink	CTV953	A320	WIII	01.35	01.35	01.40	Schedule	ST 5	
8	11/02/2022	LN1256	LionAir LN1257	B739	WIII	02.05	02.07	02.07	Schedule	ST 3		
9	11/02/2022	AWQ830	AirAsia AWQ831	A320	WIII	02.25	02.30	02.32	Schedule	ST 3		
10	11/02/2022	SJV3902	SJL3903	B739	WIII	02.25	02.31	02.36	Schedule	ST 4		

Figure 14. Search menu display based on date

Figure 14 is a display of the search menu parking stand slot for AMC users. To find the parking stand slot data you want to search for, you can type the call sign you want to search for in the text box and click the search button. Data searches can also be done based on flight time. AMC users can select a date by clicking the calendar button. Then the information you are looking for will appear.

Figure 15. Display to Add Slot Parking Stand Form

Add parking stand slot form in Figure 15 is for storing parking stand slot data. This form is used if the AMC user wants to manage (add, change and view). If you want to add parking stand slot data, then the AMC user must fill in data in the slot of date of flight, flight operator, arrival, departure, type of aircraft, originator, schedule, estimate, actual, flight status and stand. The AMC section can save parking stand slot data by clicking the save button.

Figure 16. Parking Stand Slot Data Saved

In figure 16 notification saved data appears when the button “Save” has been clicked and the parking slot data is automatically entered into the available datagridview. The AMC section can view existing parking stand slot data via datagridview.

Figure 17. Parking Stand Slot Appearance Changed

The data that has been clicked on will be displayed by the system in the parking stand slot entry form. AMC users can make changes to the data and then the AMC section must click the change button so that the parking stand slot data is updated. Changes to the parking stand slot data that have been changed will be included in the change notification (Figure 17).



Figure 18. Confirm Data Delete Menu

The data that has been clicked on will be displayed by the system in the parking stand slot entry form. AMC users can delete data by clicking the delete button so that the parking stand slot data is deleted. Before deleting the parking stand slot data, a data deletion confirmation notification will appear. If the user wants to delete data, they can click the "Yes" button, but if the user wants to cancel the deletion command, the user can click the "No" button (Figure 18).

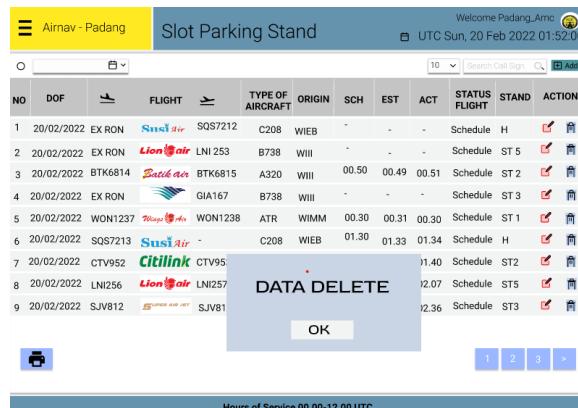


Figure 19. Delete Menu Display

In figure 19, the notification delete data will appear when the button "Yes" clicked and the parking slot data is automatically deleted from the available grid view data.

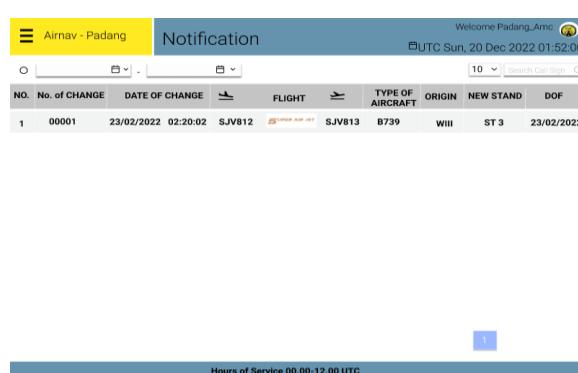


Figure 20. AMC Notification Menu Display

Figure 20 shows the notification menu display for AMC users. Users can search notifications based on the date of change and based on the call sign. Display on the notification menu for AMC and TWR users have similar appearance and usage.

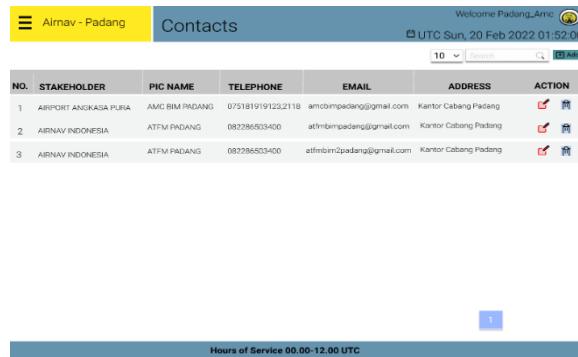


Figure 21. AMC Contacts display

Figure 21 is a display of the form contacts on AMC users. AMC users can add, edit and delete contacts data. To add new contacts data, the user can click the add button. If the AMC user wants to print parking stand slot data, the user can click the print button and a parking stand slot information display will appear ready to be printed.

NO.	STAKEHOLDER	PIC NAME	TELEPHONE	EMAIL	ADDRESS	ACTION
1	-	-	-	-	-	
2	-	-	-	-	-	
3	-	-	-	-	-	

Hours of Service 00.00-12.00 UTC

Figure 22. Add Contacts Menu Display

Add contacts form in Figure 22 is for saving contacts data. This form is used if the AMC user wants to manage (add, change and view). If you want to add new contacts data, the AMC user must fill in the data in the stakeholder, PIC Name, Telephone, E-mail and Address. The AMC section can save contacts data by clicking the save button.

NO.	STAKEHOLDER	PIC NAME	TELEF	DATA SAVED	ADDRESS	ACTION
1	AIRNAV INDONESIA	TWR PADANG	081294	OK	Cabang Padang	
-	-	-	-	-	-	
-	-	-	-	-	-	

Hours of Service 00.00-12.00 UTC

Figure 23. Saved Contacts Menu Display

In figure 23 notification saved data appears when the button “Save” has been clicked and the contacts data is automatically entered into the available datagridview. The AMC section can view existing contacts data via datagridview.

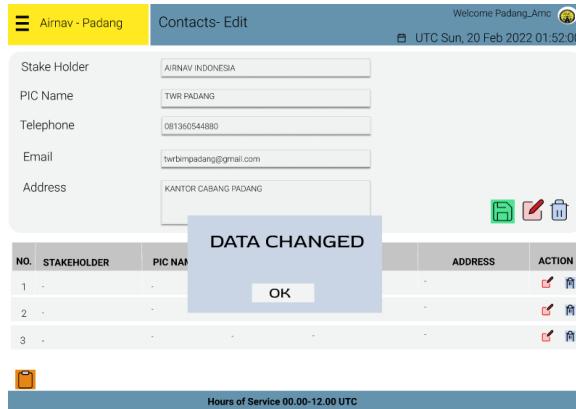


Figure 24. Changed Contacts Menu Display

In Figure 24, the data that has been clicked on will be displayed by the system in the contacts form. AMC users can make changes to the data and then the AMC section must click the change button so that the contacts data is updated.

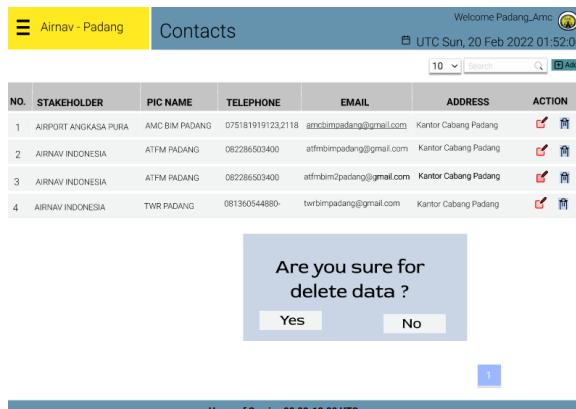


Figure 25 Confirmation Deleted Data Contacts

The data that has been clicked on will be displayed by the system in the contact slot form. AMC users can delete data by clicking the delete button so that contact data is deleted. Before deleting contacts data, a data deletion confirmation notification will appear. If the user wants to delete data, they can click “yes” button, but if the user wants to cancel the deletion command, the user can click the “No” button (Figure 25).

To determine the usability of this design, a sample questionnaire consisting of 15 questions is given as in Table 1 below:

Table 1. Sample Questionnaire

No.	Pertanyaan	SS	S	C	TS	STS
1	POSTAND mampu mendorong pekerjaan ATC menjadi lebih efisien dan efektif	<input type="checkbox"/>				
2	Proses pencarian data menjadi lebih mudah dengan sistem yang sudah terkomputerisasi	<input type="checkbox"/>				
3	POSTAND menyediakan fitur yang dibutuhkan dan sesuai oleh kebutuhan pilot ATC dan AMC	<input type="checkbox"/>				
4	POSTAND menyediakan informasi yang lengkap dan bermanfaat untuk kegiatan operasional	<input type="checkbox"/>				
5	Dengan menggunakan POSTAND airnav cabang Padang mendukung dan berkontribusi dalam era <i>Society 5.0</i> dalam dunia penerbangan	<input type="checkbox"/>				
6	POSTAND mudah dioperasikan	<input type="checkbox"/>				
7	POSTAND dapat menampilkan informasi yang dibutuhkan oleh ATC dengan tampilan yang sudah divisualisasikan kedalam sistem	<input type="checkbox"/>				
8	POSTAND dapat mengurangi <i>workload</i> ATC	<input type="checkbox"/>				
9	POSTAND lebih ramah lingkungan karena <i>paperless</i>	<input type="checkbox"/>				
10	POSTAND memiliki fitur yang mudah untuk dipelajari	<input type="checkbox"/>				
11	Cara pengoperasian POSTAND mudah untuk diingat	<input type="checkbox"/>				
12	Fasilitas kantor mendukung untuk akses ke sistem POSTAND	<input type="checkbox"/>				
13	Tampilan POSTAND menarik untuk dilihat	<input type="checkbox"/>				
14	POSTAND berfungsi sesuai dengan kebutuhan ATC	<input type="checkbox"/>				
15	POSTAND adalah system yang sesuai untuk diterapkan pada airnav cabang Padang	<input type="checkbox"/>				

A questionnaire was developed to determine the level of usability of the POSTAND system. The questionnaire in Table 2 was developed by adopting the usability aspect assessment criteria in the USE Questionnaire developed by Arnold Lund. Indicators of usability aspects include (1) usefulness, (2) ease of use, (3) ease of learning, (4) satisfaction(Sylvia & Liber Tommy Hutabarat, 2021).

Table 2. Questionnaire Instrument

No	Aspects	Indicators	Items
		Usefulness (Use of POSTAND for ATC operational activities)	1,2,3,4,5
		Ease of Use (Ease of using POSTAND)	6,7,8,9
1	Usability	Ease of Learning (Ease of learning to use the system)	10,11
		Satisfaction (Satisfaction in using the POSTAND system)	12,13,14,15

DISCUSSION

The use of information systems in aviation has been permitted and has also been regulated in Law of the Republic of Indonesia Number 1 of 2009 concerning Aviation Chapter XVIII concerning Aviation Information Systems and has been explained in Law of the Republic of Indonesia Number 11 of 2008 concerning Information and Electronic Transactions Article 17 Paragraph (1) reads "This law provides opportunities for the use of information technology by state administrators, people, business entities and/or the public. The use of information technology must be carried out well, wisely, responsibly, effectively and efficiently so that maximum benefits can be obtained for society."

In order to utilize the information system in aviation, it is necessary to develop an application called POSTAND (Padang Online Parking Stand). POSTAND is an information system that uses information technology to display information about parking stand slots that controllers need to achieve their main goals, namely ensuring safety, order and smoothness of flight traffic services, as well as increasing flight efficiency. With this application, it is hoped that excessive and ineffective coordination can be reduced, so that the objectives of the Air Traffic Flow Management Document (ICAO, 1984) service can be achieved. One of these objectives is to ensure that air traffic controllers do not experience overload work by regulating and limiting existing capacity. This can be achieved through two steps, namely:

1. Optimizing air traffic (traffic flow) by best using available capacity when demand increases or is expected to increase.
2. Controlling aircraft movements safely, regularly and quickly according to existing capacity.

Thus, POSTAND is expected to be an effective solution in increasing efficiency and safety in flight operations and helping controllers carry out their duties better.

To determine the effectiveness of POSTAND as one of the developments in information technology in aviation, a questionnaire was given to previously determined respondents. The validity of each item is shown by the total column. Based on the r table, the minimum Pearson Correlation value is 0.6226 because it uses 14 respondents (N) with a limit of 0.01. It can be seen that all Pearson Correlation values for each item are above 0.6266. This is marked with an * or ** in the column in the output table so that the 8 questionnaire items are considered valid.

Table 3. Descriptive Statistics

	N	Min.	Max.	Mean	Std. Dev.
Usefull1	14	1	2	1.79	.426
Usefull2	14	1	2	1.79	.426
Usefull3	14	1	3	2.00	.555
Usefull4	14	1	3	2.07	.475
Usefull5	14	1	3	2.00	.392
EOU1	14	1	3	1.93	.616
EOU2	14	1	2	1.86	.363
EOU3	14	1	3	1.86	.663
EOU4	14	1	2	1.50	.519
EOL1	14	1	3	2.00	.555
EOL2	14	1	3	2.07	.616
Satis1	14	1	3	2.29	.611
Satis2	14	1	3	2.00	.555
Satis3	14	1	3	1.93	.475
Satis4	14	1	2	1.71	.469

TOTAL	14	20	36	28.79	4.660
RATA RATA				1.91	

From the results of data processing in this research, the category "agree" was obtained if POSTAND was applied to Airnav Padang branch. POSTAND has been proven to receive a positive response from ATCs, has good feasibility, and can increase effectiveness and efficiency in helping ATC and AMC work to coordinate daily operational activities.

The advantage of POSTAND compared to the systems that have been implemented at Medan Airport (Figure 26), Surabaya (Figure 27) and Makassar (Figure 28) is that there are many features that can be utilized for airport operational needs. The POSTAND system not only provides information about parking stands, but also provides additional features that expand its functionality.

One of the prominent features in POSTAND is the contact menu, which allows Air Traffic Controllers (ATC) to save contacts needed to carry out operations. This feature makes it easier for ATC to access and communicate with related parties more quickly and efficiently. This can have a positive impact on coordination and collaboration between officers, as well as speeding up responses in emergencies or changes in plans.

In addition, many additional features in POSTAND can increase ATC productivity and work efficiency, because this system is designed to better support their tasks. More complete and easily accessible information from this system can help ATC make more precise and accurate decisions, so that the safety and smoothness of flight traffic can be more guaranteed.

Thus, the presence of additional features such as the contact menu in POSTAND differentiates it from existing systems at Medan, Makassar and Surabaya airports, and can provide significant benefit in supporting airport operations and improving ATC performance.

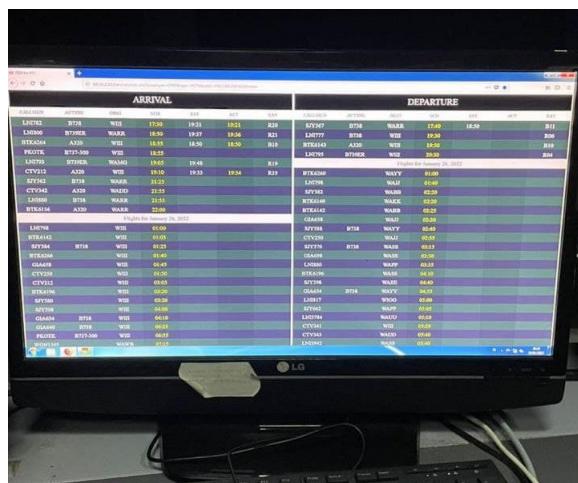


Figure 26Medan Parking Stand Application
 Source: Kualanamu International Airport



Figure 27 27Application
Source: Juanda International Airport



Figure 28Makasar Parking Stand Application
Source: Sultan Hasanuddin International Airport

It is hoped that by designing this application, Perum LPPNPI Padang Branch can develop this application so that it can be used in operations so that the provision of flight traffic services at Perum LPPNPI Padang Branch becomes more effective, efficient and accurate.

CONCLUSION

The conclusions that can be drawn from this research are as follows: The design of POSTAND in this research uses the RAD methodology with the R&D research stage to produce a design with a display that is more user friendly, informative and able to accommodate a more varied menu display. The research results obtained are in the "agree" category if implemented. POSTAND is considered effective as a coordination medium between Air Traffic Controller (ATC) officers and Apron Movement Control (AMC) officers. POSTAND as a system that helps operational activities shows high effectiveness compared to the system currently running. This can be assessed from the aspects of usefulness, ease of use, ease of learning and satisfaction. This research is still at the design stage so it is hoped that in the future this design can be realized into an application that can be used by Airnav and can then be developed according to needs in the field to help smooth operational tasks at airports.

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